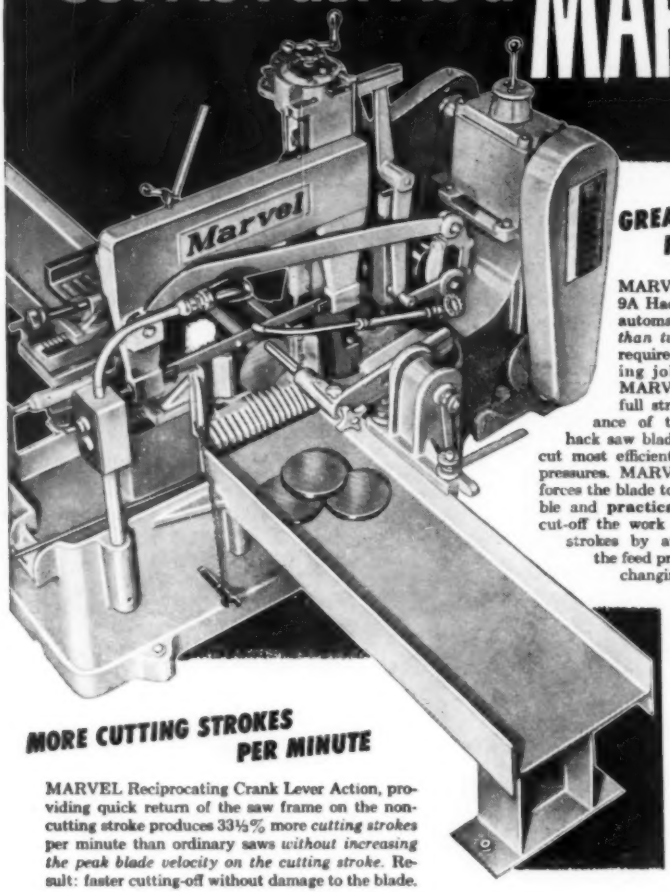
A HITCHCOCK PUBLICATION

DECEMBER • 1959

Machine and Tool BLUE BOOK

Still no substitute for His star

How Can Any Hack Saw Cut As Fast As a MARVEL?



GREATER EFFECTIVE FEED PRESSURE

MARVEL Series 6, 6A, 9 and 9A Hack Saws are capable of automatically applying *more than twice the feed pressure* required for most hack sawing jobs. This means that MARVEL Saws can utilize the full strength and heat resistance of the modern composite hack saw blade which is designed to cut most efficiently under heavier feed pressures. MARVEL Dual Power Feed forces the blade to cut as deeply as possible and **practical** on every stroke—to cut-off the work in the fewest possible strokes by automatically adjusting the feed pressure in relation to the changing work resistance.

MORE CUTTING STROKES PER MINUTE

MARVEL Reciprocating Crank Lever Action, providing quick return of the saw frame on the non-cutting stroke produces 33⅓% more *cutting strokes* per minute than ordinary saws *without increasing the peak blade velocity on the cutting stroke.* Result: faster cutting-off without damage to the blade.

With far greater feed pressures automatically available, plus more cutting strokes per minute, is it any wonder that MARVEL Series 6 and 9 Hack Saws will give you faster, accurate cutting-off every time?

Catalog C85 has complete details, facts and figures on both Marvel metal cutting Hack Saws and Band Saws. Write for it today.

Marvel Saws

ARMSTRONG-BLUM MFG. CO.
5700 BLOOMINGDALE AVE. • CHICAGO 39, ILLINOIS

FS-1301

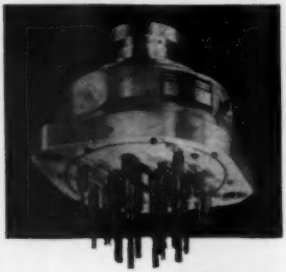
MARVEL Metal Cutting SAWS
Better Machines—Better Blades

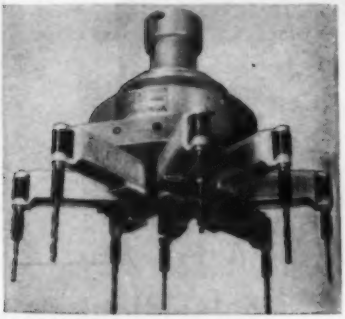
ZAGAR HEADS ...for Drilling Reaming & Tapping

FOR ANY NUMBER OF HOLES, IN ANY MATERIAL, IN ANY PATTERN, ON ALL CENTERS

FIXED CENTER HEADS

Up to 1500 holes made simultaneously. As close as the sum of the hole diameters; in varying diameters up to 1½". Zagar heads serve on special machinery, as a complete tooled unit, or on your standard drill press. More data in Engineering Sheets 66 through 68-B.





ADJUSTABLE SPINDLE GEARLESS HEADS

No universal joints

No bulky gear clusters

No flexible shafts

The engineering advantages of gearless design are applied to Zagar's adjustable spindle head. Any hole pattern within a bolt circle diameter of 23". Hole patterns easily, economically changed. Get bulletin 658-B.

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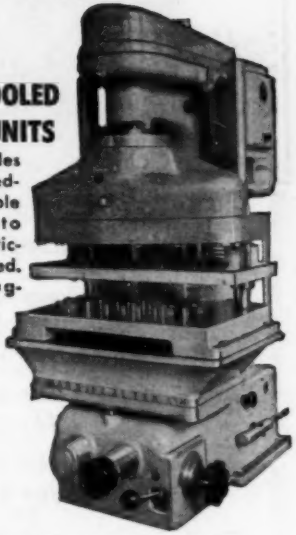
Up to 300 holes made by this fixed-head machine. Table feeds work into spindles, automatically by air-oil feed. Self-contained, rugged performer, accurate producer. Get Bulletin 44-B.



Zagar INCORPORATED

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it's NEW!

2¼" Collet Capacity Electric Clutch HAND TURRET LATHE

Designed specifically to release large machines from bar work and from second-operation work that can be performed more economically on this size lathe. *Especially suited for machining non-ferrous materials and tubing.*

- for LARGER CAPACITY
- for FINER FINISH
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- for LOWER COST OPERATION
- for EASE OF OPERATION

Built to meet the needs of the modern shop
. . . by WADE, lathe makers since 1872

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MAKERS OF PRECISION MACHINE TOOLS FOR AMERICAN INDUSTRY

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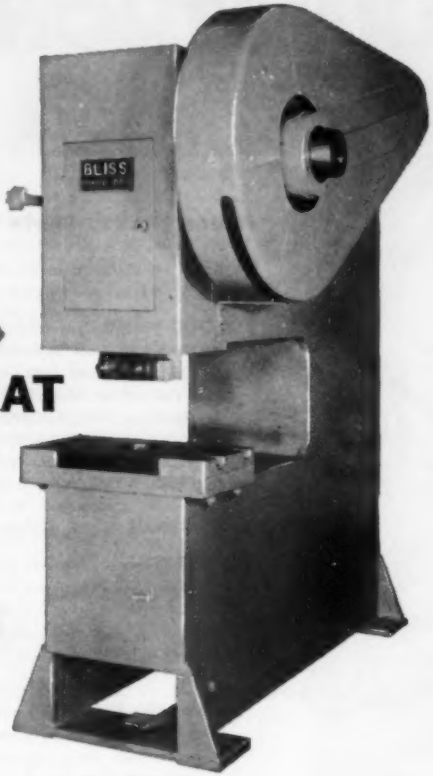
NEW

line of Bliss presses featuring



DEEP THROAT

All moving parts are interchangeable with standard inclinables

Rugged, compact, these reinforced welded steel frame presses are designed to give maximum rigidity and minimum "spring" under load.

All moving parts enclosed for greater safety—yet instantly accessible for adjustment. Probably most important is that these parts are *standard* Bliss inclinable press parts. This means you can be sure of quick parts service wherever you're located!

Sizes range from 4-ton bench models with a 12″ throat to a 60-ton press with a throat almost three feet deep. You can also have extended bodies, mechanical or air friction clutches, automatic lubrication, other features. Why not write for details.

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SINCE 1857

is more than a name . . . it's a guarantee!

E. W. BLISS COMPANY · Canton, Ohio

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ARMSTRONG

Quality TOOLS

More than meets the eye

There are extra values in ARMSTRONG TOOLS that become apparent only with use.

TOOL SENSE— convenience in use — the most efficient *"tool approach"* built into ARMSTRONG Tool Holders; the balance and *"feel"* of an ARMSTRONG Wrench; the *rigidity* of ARMSTRONG "C" Clamps; the extra *toughness* of ARMSTRONG Lathe Dogs and Eye Bolts; the universal *adaptability* of ARMSTRONG Set-up and Hold-down Tools — the evidence of "tool sense", the understanding of each tool's requirements.

STRENGTH — built into each individual ARMSTRONG TOOL is a safety factor of extra *strength* — *strength* beyond any need, the inherent strength of specially selected materials enhanced by proper heat treatment and hardening.

UNIFORM QUALITY — the uniform quality made possible by modern manufacturing methods, in a specially-built plant equipped with every needed quality control. The name ARMSTRONG with the Arm-and-Hammer Trade Mark is universally recognized as a guarantee of finest quality.

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ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

5208 W. ARMSTRONG AVE. • CHICAGO 46, ILL.

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DECEMBER, 1959

Machine and Tool BLUE BOOK

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METAL CUTTING BAND SAW MACHINES

...there's a model to meet your needs

Kalamazoo
MODEL 8C

An all new design, first to meet today's metal cutting needs. Embodies years of *Kalamazoo* experience and the best industrial design talent. Cuts 8" round, 16" flat, 8" pipe. Available with or without coolant equipment.

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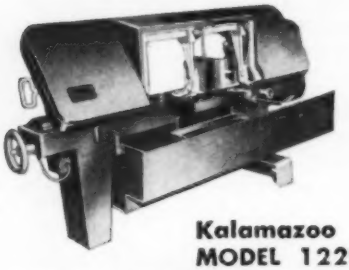
An automatic cut-off machine. $1485, complete. A low cost, completely automatic operation, job tested and approved for accuracy and efficiency, using low cost carbon blades.



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MODEL 1220

Where heavy-duty cutting is a problem, you'll find this rugged saw easy to use. Cuts 12" round, 20" flat. Available with or without coolant equipment.

Kalamazoo
MODEL 610

Here's a low-cost saw that heating, plumbing and electrical contractors go for! Easy to move around in the shop or take along to the job. Cuts 6" round and 10" flat. Available with or without coolant equipment.

It will pay you to investigate KALAMAZOO. Ask your dealer for a demonstration or write for descriptive literature and name of your nearest dealer.

MACHINE TOOL DIV. *Kalamazoo* TANK and SILO CO.

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Rodgers Presses

PRECISION HYDRAULIC POWER

FOR METAL FORMING and DRAWING

From Rodgers "Standard" Line
Select your "Custom" Model

Easy as A B C:

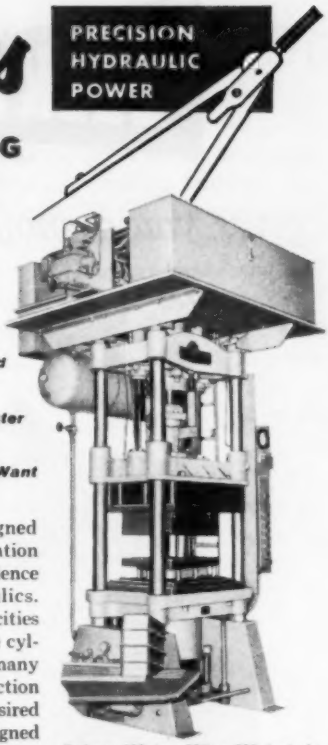
A — *Determine Press Tonnage and Style Press You Need*

B — *Bed and Frame Size Required... Solid or Open Bolster*

C — *Select Pump Unit and Controls To Give Speed You Want*

The New Standard line of Rodgers Platen Presses has been designed to greatly simplify press selection. From the basic press styles, one may be selected and combined with varied pumps and controls, automatic, semi-automatic or pressure sensitive, to give the desired speed and performance. This results in savings of "custom" engineering and costs.

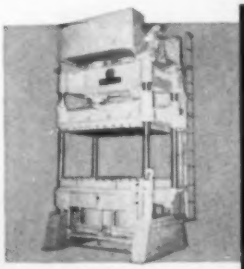
Rodgers Presses are designed and built by an organization with over 32 years' experience in high pressure hydraulics. They are available in capacities from 50 to 400 tons, single cylinder or twin cylinders, in many standard models for production or special uses. Where desired custom models will be designed to suit exacting special requirements.



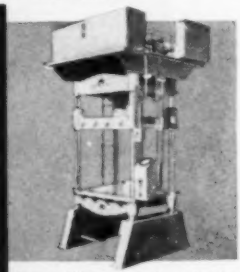
Rodgers 100 ton 30" x 30" bed size with complete one cycle automatic control for deep drawing.

SEND FOR *NEW* CATALOG 337...

This new Rodgers Catalog has complete specifications, tables and data, making it simple to determine the press for the job. Write for your copy without obligation.



Rodgers twin cylinder, twin die cushion 200 ton drawing press with 60" x 48" bed; single cycle automatic.



Rodgers 100 ton press, 36" x 36" bed with single lever pressure sensitive manual control.

HYDRAULICS Rodgers KEEP THE WORLD MOVING

RODGERS HYDRAULIC, Inc.

Pioneers in High Pressure Hydraulics Since 1932

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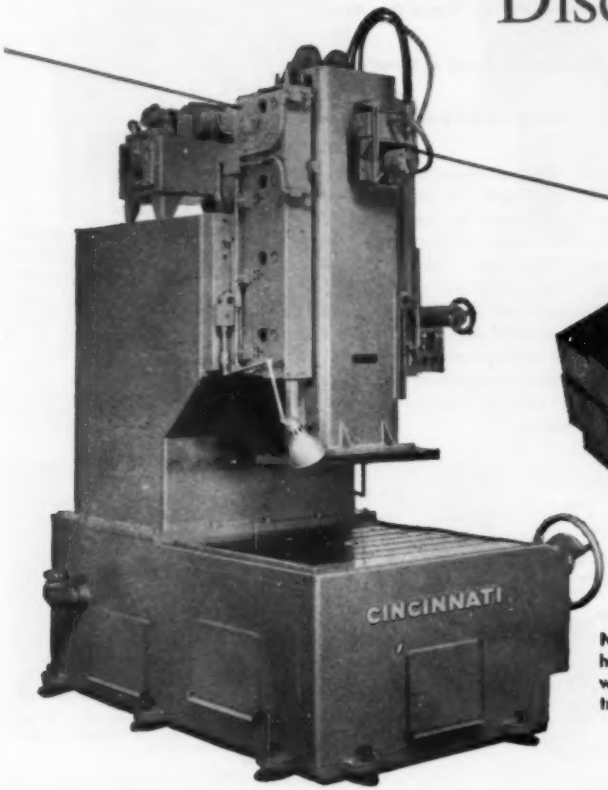
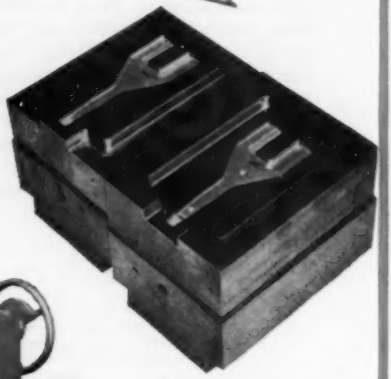
gives you a choice of 35 Electrical Discharge Machines





NO. 3 ELEKTROJET. This machine has the capacity for large heavy work, like the 15" long dies illustrated here.

BUILDERS OF FINE MACHINE TOOLS: KNEE TYPE AND BED TYPE MILLING MACHINES • DIE SINKING MACHINES

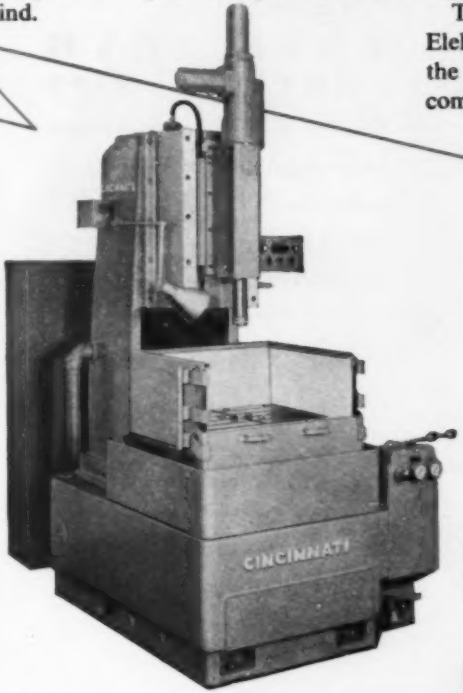
THE CINCINNATI MILLING MACHINE CO., CINCINNATI 9, OHIO

Elektrojet® ELECTRICAL DISCHARGE MACHINES | CINCINNATI

Advantages offered by electrical discharge machining are greatly extended by Cincinnati's new line of Elektrojet Machines. There are 35 variations in the line, covering the requirements for unusual or "impossible" machining operations on a wide variety of parts ranging from small missile components to forging dies. Elektrojet Machines are designed from the machine tool builder's viewpoint, with a high degree of dependable performance in mind.

Four styles of workheads are available: non-rotating, rotating, ram-type and universal. For all of them, a servo feed unit maintains proper gap between electrode and work to assure maximum efficiency of metal removal. Other beneficial features: two styles of work tables, fixed or adjustable . . . four styles of dielectric tanks, solid, open front, disappearing or moving table . . . a selection of power supply units.

There are many other reasons why Elektrojet engineering and machines are the finest. Folder M-2077 contains the complete story. Write for a copy.



No. 1 ELEKTROJET with non-rotating workhead. Typical work is the extrusion die shown above, about 2⅞" outside diameter. Operation, EDM gear teeth through center.

CUTTER AND TOOL GRINDERS • ELECTRICAL DISCHARGE MACHINES

CINCINNATI
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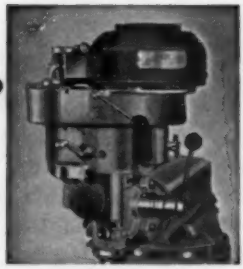

variable speeds 60 to 3300 r.p.m.

TREE 2UVR
VERTICAL MILL

Spindle speeds infinitely variable from 60 to 3300 r.p.m. make the 2UVR Vertical Mill useful for a wide range of work not heretofore accomplished by mills of this size. Exclusive features include:

- Roller Spindle Drive
- Automatic Collet Closer
- Head to Ram Mounting
- Power Table Feed and Rapid Traverse
- Turret Locking Mechanism

For full information write,

TREE TOOL & DIE WORKS

1600 JUNCTION AVE., RACINE, WIS.

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For best results in Surface Grinding . . . Always Use Blanchard Wheels!

The flexibility in application of your Blanchard Surface Grinder enables you to attain peak production at lowest cost on hundreds of different grinding jobs. *But, it is very important that you use the right wheel for each job!*

Blanchard makes and stocks a great variety of silicate, resinoid and vitrified bonded wheels and segments. Ask your Blanchard representative to help you select the wheel.—or wheels—best suited to your requirements. Call or write him today. And may we send you a copy of "The Art of Blanchard Surface Grinding" (4th Edition)?

THE BLANCHARD MACHINE COMPANY
64 State Street,
Cambridge 39, Mass., U. S. A.

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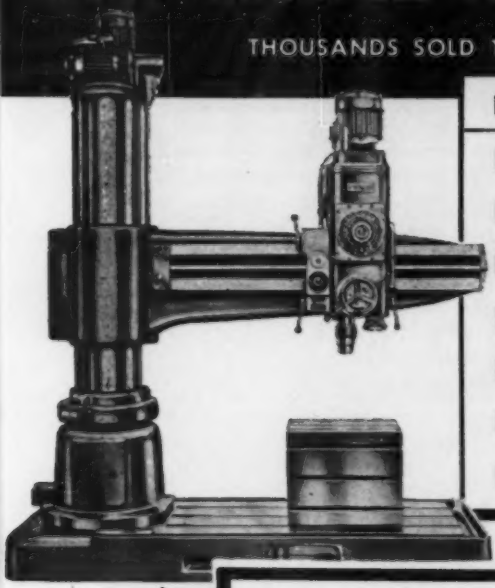
UNBELIEVABLE VALUES!...

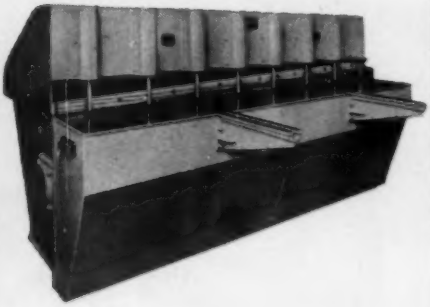
IMPERIAL RADIAL DRILLS

THOUSANDS SOLD TO SATISFIED CUSTOMERS!



Model	Col. Diam. Inches	Arm	Base Price
L-26	7½	26"	$1995.
L-2½	8½	2½'	$2085.
L-3	8¼	3'	$2195.
M-3PE	10	3'	$3995.
M-4PE	12⅜	4'	$4985.
M-5PE	14	5'	$6295.
M-6PE	14	6'	$6985.

IMPERIAL WIEGER Guillotine Shears



- ALL STEEL CONSTRUCTION
- SINGLE STROKE CONTROL
- PERMANENT ACCURACY

8" gaps on all models. Cuts thin and heavy gauge accurately.

Length	Capacity	Price
6'	10 gauge	$3595.
8'	12 gauge	$4395.
10'	12 gauge	$5195.
6'	3/16 inch	$5190.
8'	10 gauge	$5495.
10'	10 gauge	$5795.
6'	7/32 inch	$6190.
8'	3/16 inch	$6495.
10'	3/16 inch	$6795.

AARON MACHINERY CO., Inc.

DEPT. B 45 CROSBY ST., N. Y. 12 • WA 5-8300

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BRANCHES AT:
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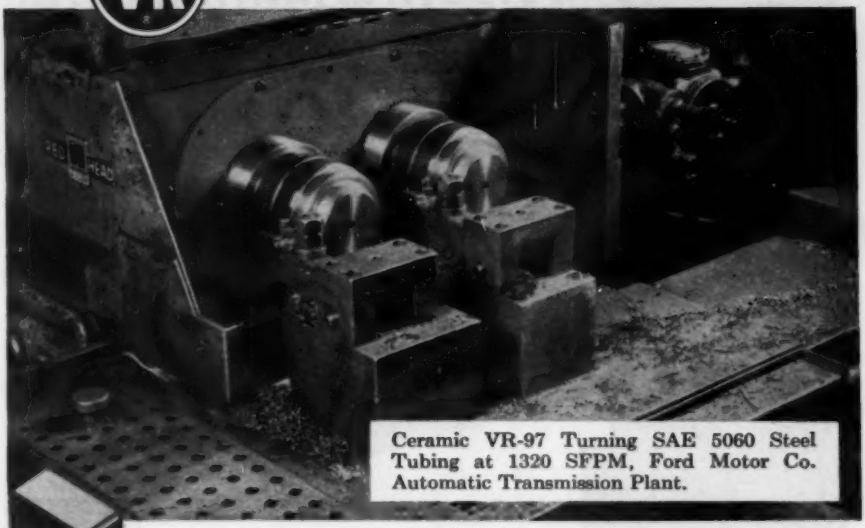
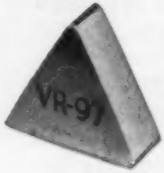
HOUSTON, TEXAS

SEE OTHER AD ON PAGE 23

Ceramic VR-97



Ceramic VR-97 Turning SAE 5060 Steel Tubing at 1320 SFPM, Ford Motor Co. Automatic Transmission Plant.



Proven in production at Ford Motor Company

Ceramic VR-97 is a proven performer in many machining operations at the Ford Motor Company's Automatic Transmission Plant, Livonia, Michigan. Here, and in hundreds of other progressive plants across the nation, VR-97 has been proving its value on continuous production runs. People who considered ceramic tooling as merely "experimental" a short time ago now rely on ceramic VR-97 as an important part of their production picture. Whether you are interested in increased machine output, higher speeds, better finish or machining hardened steel and cast iron, it will pay you to know more about ceramic VR-97. Contact your nearest V-R representative or write for Product Information BULLETIN NO. 59.1.

Vascoloy-Ramet corporation

PRIME MANUFACTURERS OF REFRACTORY METALS ENGINEERED FOR THE JOB

C-729-S

854 Market Street • Waukegan, Illinois

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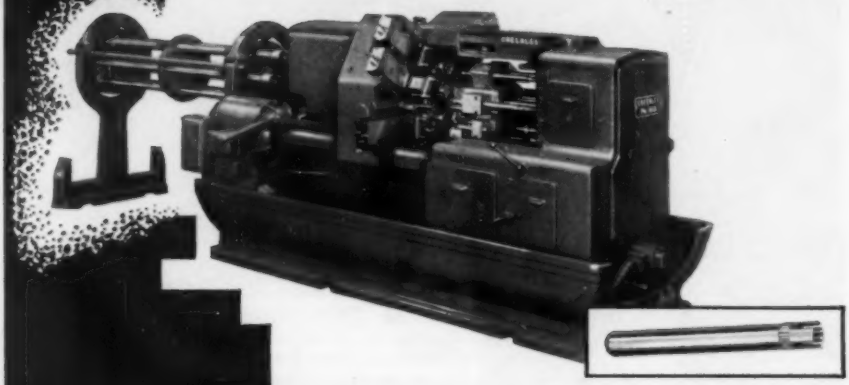
Versatile Milling with GREENLEE AUTOMATICS



Eliminates second operations on parts like these

Mill slots or flats on small diameter parts in one operation on Greenlee Automatics. Greenlee milling attachments often eliminate costly second operations on parts of this type. For example . . . slots on the part in the inset photo were milled during the machining cycle with two milling attachments on a Greenlee Automatic. Ask your Greenlee Representative to explain this and other ways you can beat rising production costs with Greenlee Automatics.

WRITE FOR CATALOG A-405

PRODUCTION MACHINERY

GREENLEE

GREENLEE BROS. & CO.
1751 MASON AVENUE
ROCKFORD, ILLINOIS

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CHECK LIST for a BEARING BUYER

PRODUCT BEARINGS, BUSHINGS AND SPECIAL PARTS OF CAST BRONZE OR SINTERED METALS ALCOA® ALUMINUM BARS

FIRM NAME *The Bunting Brass and Bronze Co. Toledo 1, Ohio*

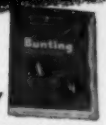
	YES	NO	REMARKS
Are its products available from stock?	✓		Readily
Do local distributors have stocks?	✓		All over America
Cast Bronze Bearings	✓		866 sizes
Sintered Oil-filled Bronze Bearings	✓		667 sizes
Cast Bronze 13" Bars	✓		267 sizes
Sintered Oil-filled Bronze 6½" Bars	✓		84 sizes
Aluminum 13" Bars	✓		138 sizes
Is it a high quality product?	✓		Bunting 72 Bronze Alloy (SAE 660) Alcoa Aluminum
Are stock sintered bearings made to ASTM Standards?	✓		Always
Any restrictions on quantity?		✓	Small lots at big run prices
Does it render extraordinary service in emergencies?	✓		Large reserve facilities
Does it have ample production capacity?	✓		Two large modern plants
Is the range of stock sizes complete?	✓		Meets every usual need
Does the company publish catalogs?	✓		See below
Does it publish technical data?	✓		In all catalogs and in special literature
Does the company make products to blueprint?	✓		Over 50,000 patterns for customer free use
Does it give competent engineering aid?	✓		It's free
Is the company well established?	✓		Over 50 years

Write for Catalogs or ask your Distributor

CATALOG 258 lists Electric Motor Bearings.

BAR CARD 40 lists 138 sizes of Bunting Bearing Aluminum 13" Bars.

CATALOG 58 lists Bunting Cast Bronze and Sintered Oil-filled Bronze Bearings and Bars.



BUNTING'S "ENGINEERING HANDBOOK ON POWDER METALLURGY" details manufacture and use of sintered metal bearings and parts.

Bunting® local distributors are listed in classified section of telephone directory under "BARS-BRONZE" or "BEARINGS-BRONZE"

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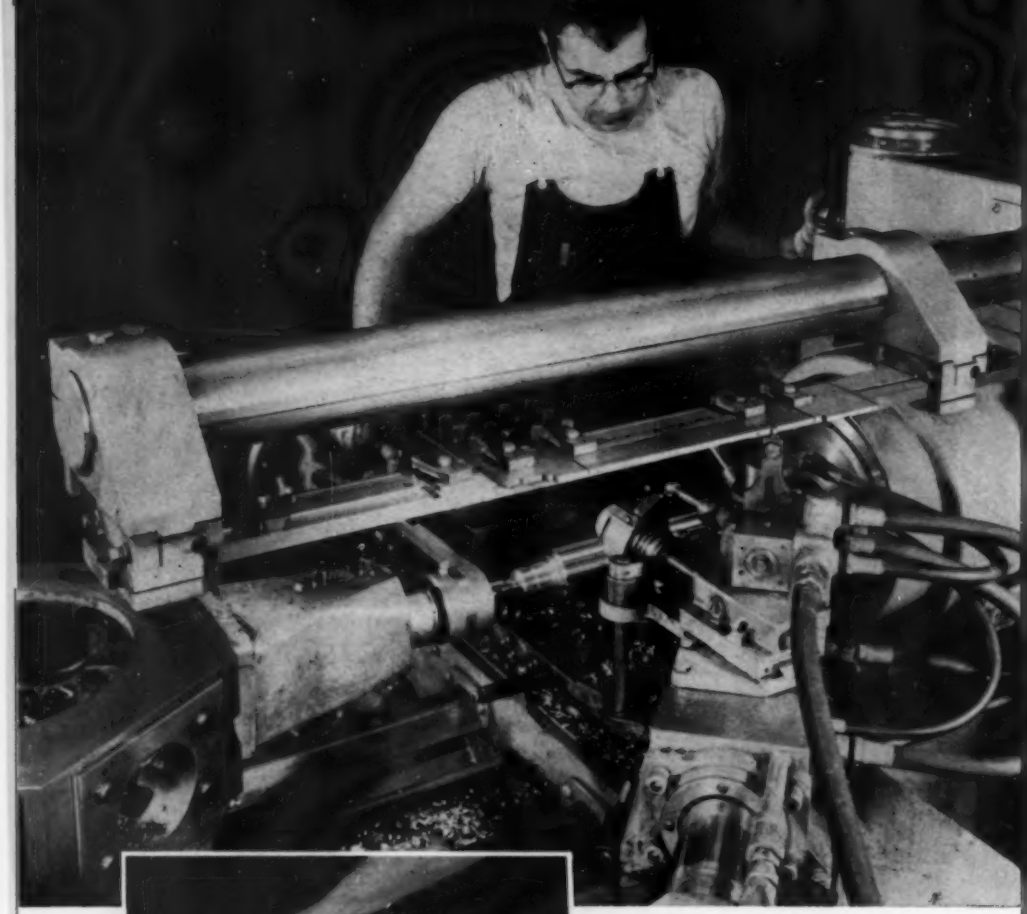
AT HOBART BROTHERS COMPANY

TROY, OHIO

a Warner & Swasey 2-A with contouring cr



Unique Section Template was one idea which Hobart tooling specialists came up with to reduce setup time and minimize template costs. A short template was made up to handle a range of shafts with similar ends. Various length middle sections could then be quickly inserted to obtain various lengths and shoulder locations.

ng cross slide SLASHES SETUP TIME FROM 2 HOURS TO 20 MINUTES

• *Combines auxiliary operations into one setup*

Hobart Brothers Co.—a leading producer of arc welding equipment and aircraft ground-power units—faced a serious production bottleneck. Long setup time on their older turret lathes and excessive part handling time was crippling the small lot production of motor-generator shafts.

Hobart launched a three-pronged attack to solve the problem by:

1. Installation of a new Warner & Swasey 2-A Saddle Type Turret Lathe equipped with a hydraulically-controlled cross slide contour unit.

2. A creative tooling approach to reduce setup time.

3. A thorough time and motion study to insure efficient utilization of daily production time.

As a result, Hobart Brothers today are producing shafts at 1948 production costs!

Contributing to the success of this efficiency study and modernization program was their new contour cross slide equipped Warner & Swasey 2-A which permitted:

- **Combining of center drilling, facing and threading operations into a single, efficient turret lathe setup reducing part handling time.**
- **Production time savings averaging 35% because of higher horsepower and spindle speeds, and elimination of extra hex turret and square turret handling time. All diameters and grinding reliefs are produced directly from the template.**
- **Holding closer tolerances which reduced grinding time and extended grinding wheel life.**

Check today with your Warner & Swasey Field Representative. He'll gladly tell you how the cost-cutting results of the "Hobart Story" can be a reality on your own operations.

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Cleveland
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$3450 BURGMASTER Turret Drill Replaces $11,000 Machine....

Reduces Machining Costs and Saves 75% Floor Space

Model 1C — 12 speeds from 325 to 4050 RPM. ½" Drill and Tap Capacity in Cast Iron — 1 H.P.

Cadillac Gage Co., West Coast Division, Costa Mesa, California, now uses a Burgmaster 1C Six Spindle Turret Drill to effect substantial savings in machining costs and floor space on a complex rocket part.

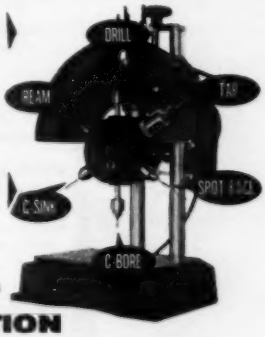
In the setup shown, six operations are performed by the turret which power indexes at operator command, confining all operations at one point, reducing jig shifting and eliminating miles of operator walking. Standard tools are used rather than expensive quick change types. On complex parts like this, tools can be changed as needed to perform a wide variety of operations such as drilling, reaming, tapping, boring, c'boring, c'sinking, spotfacing, etc. Pre-selective, automatically shifted spindle speeds and pre-set, adjustable depth stops assure top machining efficiency on all operations.

Rocket part is held in jig for performing operations from three sides. In setup shown: drill 31/64", ream .500", spotface 1½", drill 31/64", ream .500", AND port cutter for 7/16-20 thread. Depth tolerances are ± .002".

$595 Burgmaster Bench Model Turret Drill Replaces $3125 Machines.
Galvanometer Bodies are Machining 63% Faster—Tolerances ±.0005". Saved 650 miles jig moving per year, ⅓ floor space.

Dealers in important Industrial Centers. Write for literature — Covers machine and accessories.

Bench Model "O" — Speed ranges from 350 to 6200 RPM — ¼" Drill and Tap Capacity in Steel — ⅓ H.P.



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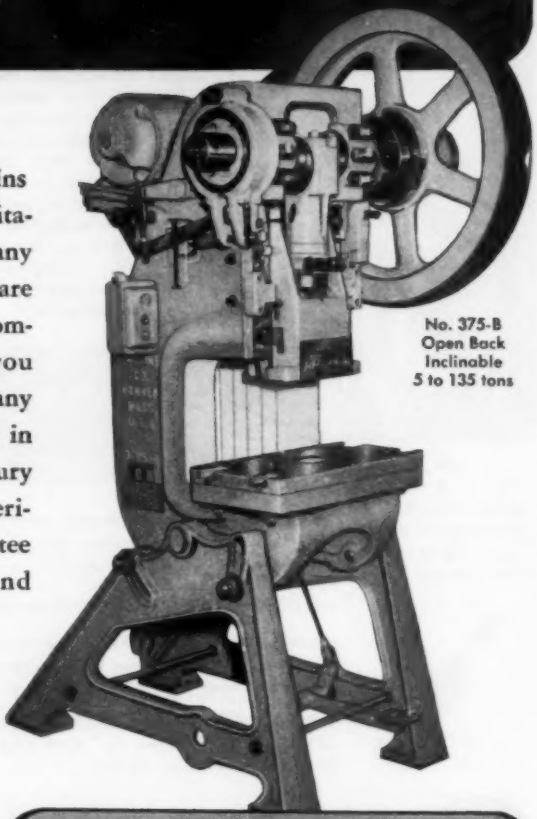

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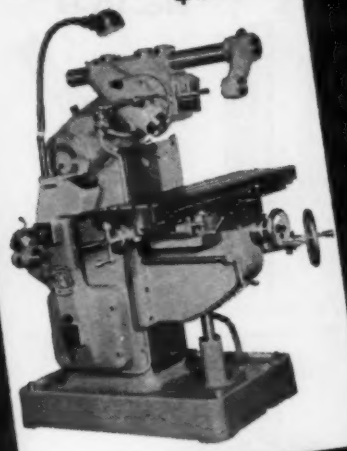

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VPU-1	51x12	$3260.
VPV-1	51x12	$3760.
VPF-2	61x12	$6185.
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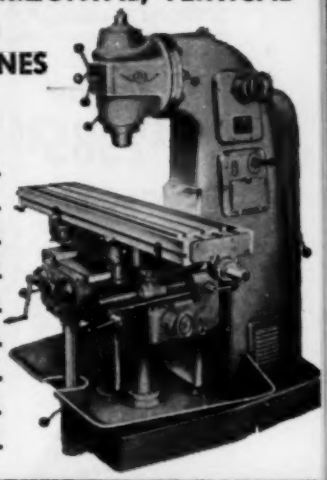
VPV-2	61x12	$6885.
VPF-4	75x16	$12850.



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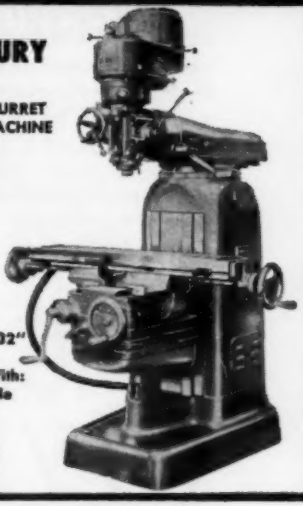
Incl. Motor & Controls



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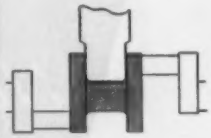

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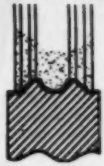

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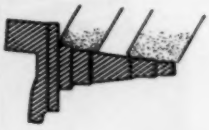

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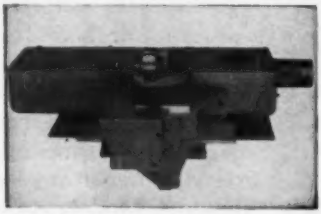

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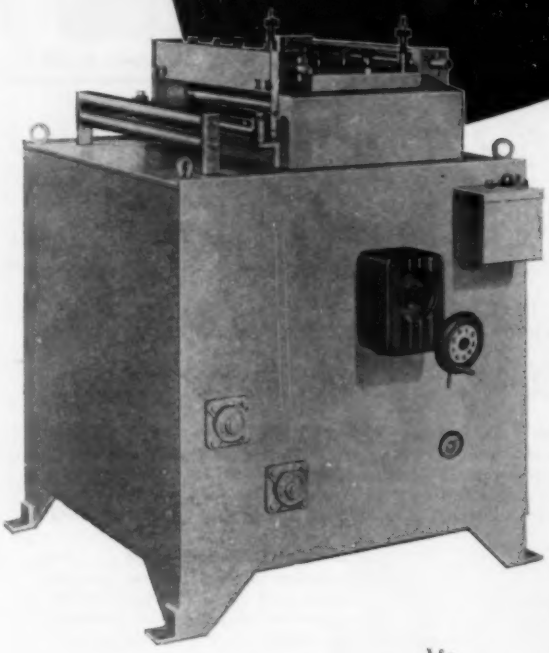

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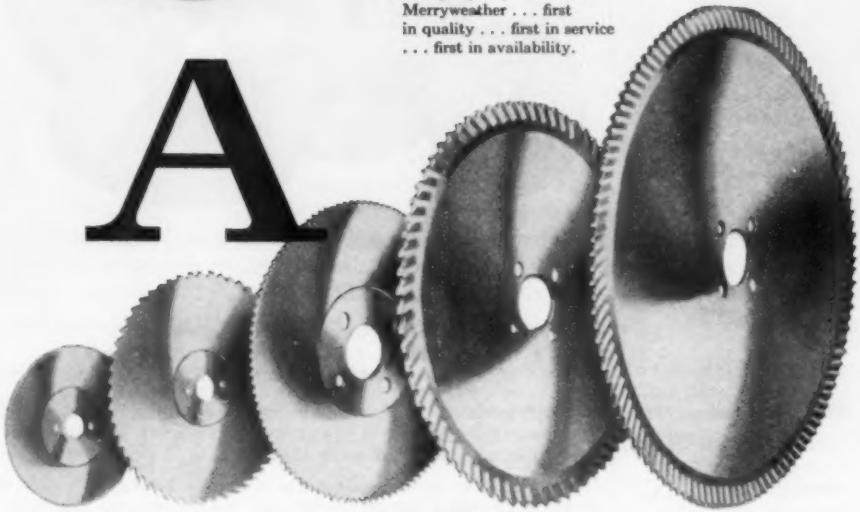

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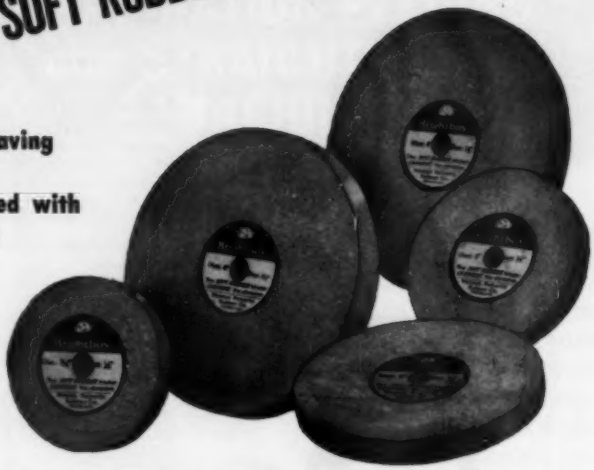

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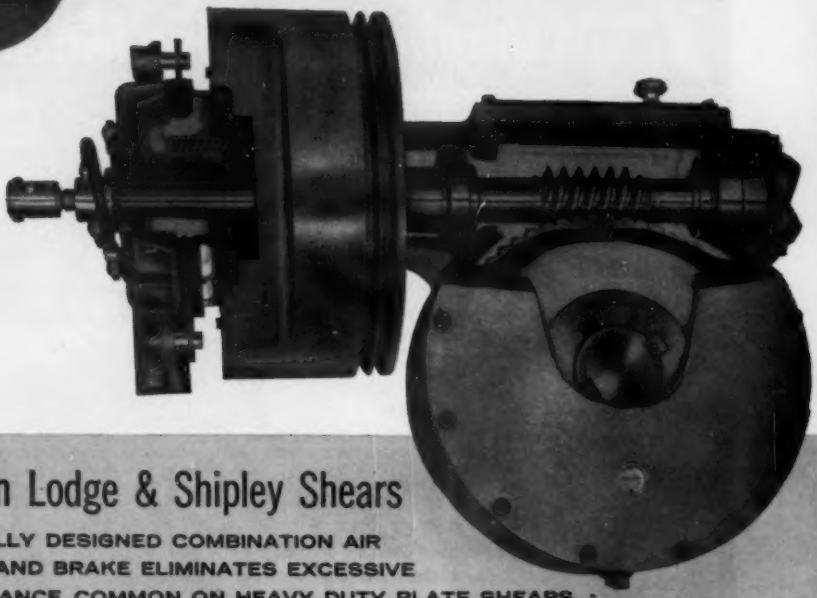

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The "standard extras" you find on Lodge & Shipley Shears, although not reflected in the price, are important in time-saving, effortless operation, accuracy and low-cost service.

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Capacities to ½" x 12'

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...with cutting capacities ranging from 3/32" mild steel for **MODEL 0** machine to 1/2" mild steel for **MODEL 530**, in sheet sizes from 16" or less, to 72".

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• CAMPBELL NIBBLERS cut from 40 to 60 times faster than drilling or filing. A fast-moving punch (350 to 900 strokes per minute) operating over a die, nibbles out the design, taking a small "bite" with each stroke of the punch.

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...with no distortion of material—no internal strains —no invisible fractures—no burr

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Campbell Nibbler Model #	Sheet Width	WORKING CAPACITY Sheet Thickness Mild Steel	Alloy Steel	Strokes per Minute
0	16"	3/32"	1/16"	900
1A	20"	3/16"	1/8"	375-650
430	60"	3/8"	1/4"	350-525
436	72"	3/8"	1/4"	350-525
530	60"	1/2"	5/16"	350-525
2524	48"	1/4"	3/16"	375-650
2536	72"	1/4"	3/16"	375-650

Send for this catalog for complete information on this versatile production and experimental tool

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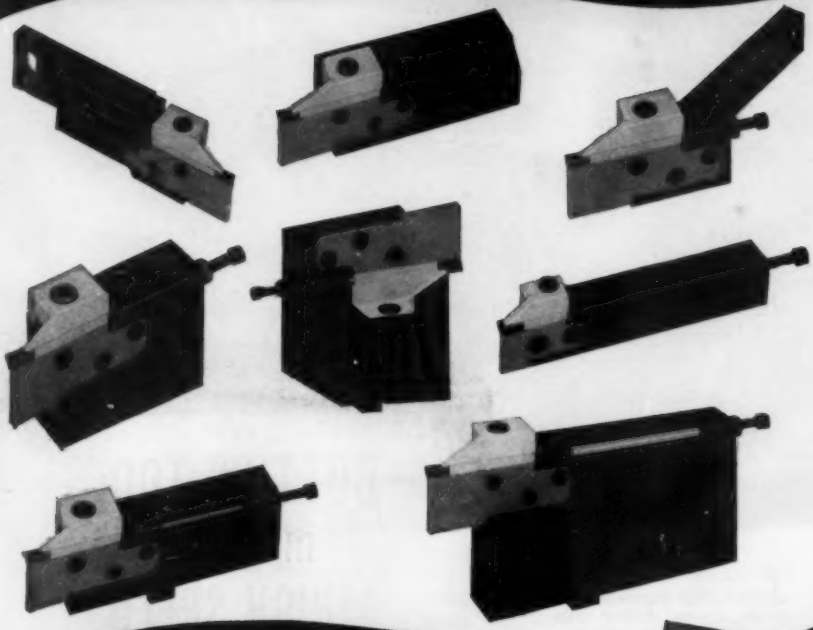

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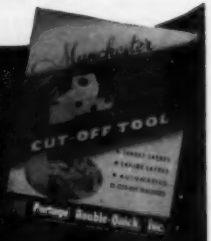

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to **MICRO-PRECISION**

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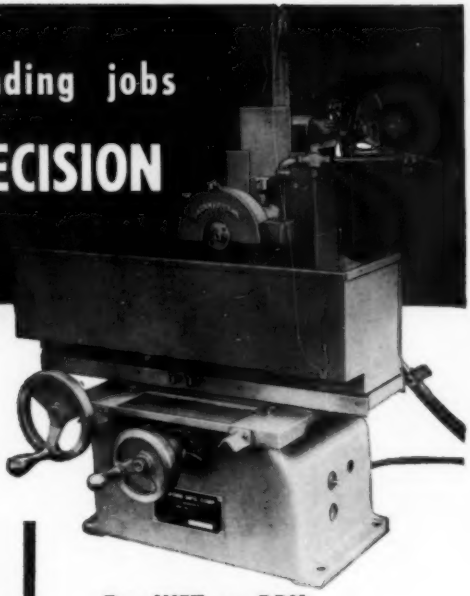

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For WET or DRY grinding, specify optional equipment.

PARTIAL SPECIFICATIONS —

Chuck Surface—3" x 5" or 4" x 6".
Table travel — 8", traverse 4".
Vertical head movement — 6".
Work area under 4" wheel — 6", with chuck — 4".
Standard grinding wheel — 4" x 3/8" x 1/2".
Spindle speed—approx. 5500 RPM.
Motor, 1/6 HP, single or 3 ph., dynamically balanced.
Dimensions—23" x 30" x 27" high.
Net wt. approx. 160 lbs.

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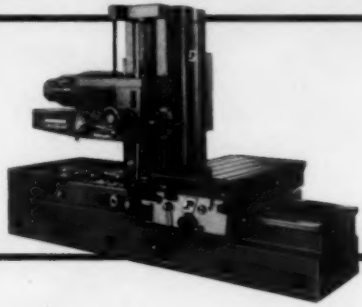
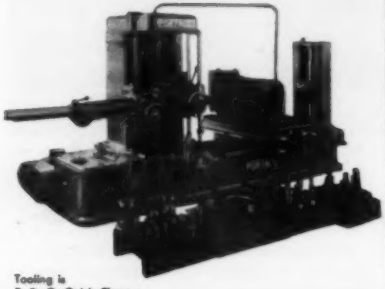
COSTS LESS TO BUY, OPERATE AND MAINTAIN

No. 3 Diameter of spindle 3"; Spindle Morse Taper No. 5; Spindle Traverse 24"; Number of Spindle Speeds 12 (Geometric Steps); Number of feeds for Table, Saddle and Head, Infinite-Variable; Working surface of Table 28" x 44"; Cross travel of Table 30"; 30" Vertical Travel of Bed; Over-all machine, 10' 7" long x 4' 8" deep x 7' 2" high. (Complete specs on request.)

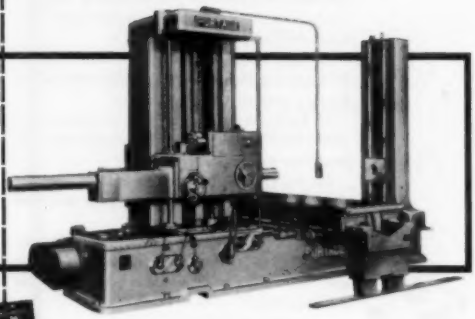




No. 4 Diameter of spindle 4"; Spindle Morse Taper No. 6; Spindle Traverse continuous 32"; Number of Spindle Speeds 36; Number of Milling Feeds to Table, Saddle and Head 18; Working Surface of Table 36" x 60"; Cross Travel of Table 48"; 36" Vertical travel of Bed; approximate net weight (Standard Machine) 34,000 lbs. (Complete specs on request.)

Tooling is P. D. Q. Quick Change

No. 5 Diameter of spindle 5"; Spindle Morse Taper No. 6; Spindle Traverse continuous 32"; Number of Spindle Speeds 34; Number of Milling Feeds to Table, Saddle and Head 18; Working Surface of Table 36" x 72"; Cross Travel of Table 48"; 48" Vertical Travel of Bed; approximate Net Weight (Standard Machine) 36,000 lbs. (Complete specs on request.)



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Portage Machine Company is completely equipped and staffed for the precision manufacture of special machines . . . ask for our brochure covering contract facilities . . .

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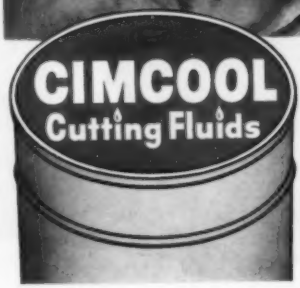
"Latest Cimcool Success Story!
Nation's best-selling chemical
cutting fluid scores again!"
SALES REPORT
2.
and this company* had been
using a good grade soluble oil
at 1:20 for machining steel.
But rancidity was making them
change the coolant every week.
So they put in Cimcool at a
1:40 dilution. That was three weeks ago.
And still not a sign of rancidity!
CIMCOOL has saved them money,
and kept production going.
Their grinding room foreman also wants
Cimcool because it has already
increased cutting fluid life three times!
Bud Hume
Detroit Office
* Name of this construction machinery manufacturer on request



FOR 100% OF ALL METAL CUTTING JOBS

Production-proved products of The Cincinnati Milling Machine Co.

CIMPERIAL—*newest* in the famous, industry-proven line of CIMCOOL® Cutting Fluids!
CIMCOOL 52 Concentrate—The pink fluid which covers 85% of all metal cutting jobs.
CIMPLUS—The transparent grinding fluid which provides exceptional rust control.
CIMCUT Concentrates (AA, NC, 55)—For every job requiring an oil-base cutting fluid.
ALSO—CIMCOOL Tapping Compound—CIMCOOL Bactericide—CIMCOOL Machine Cleaner.

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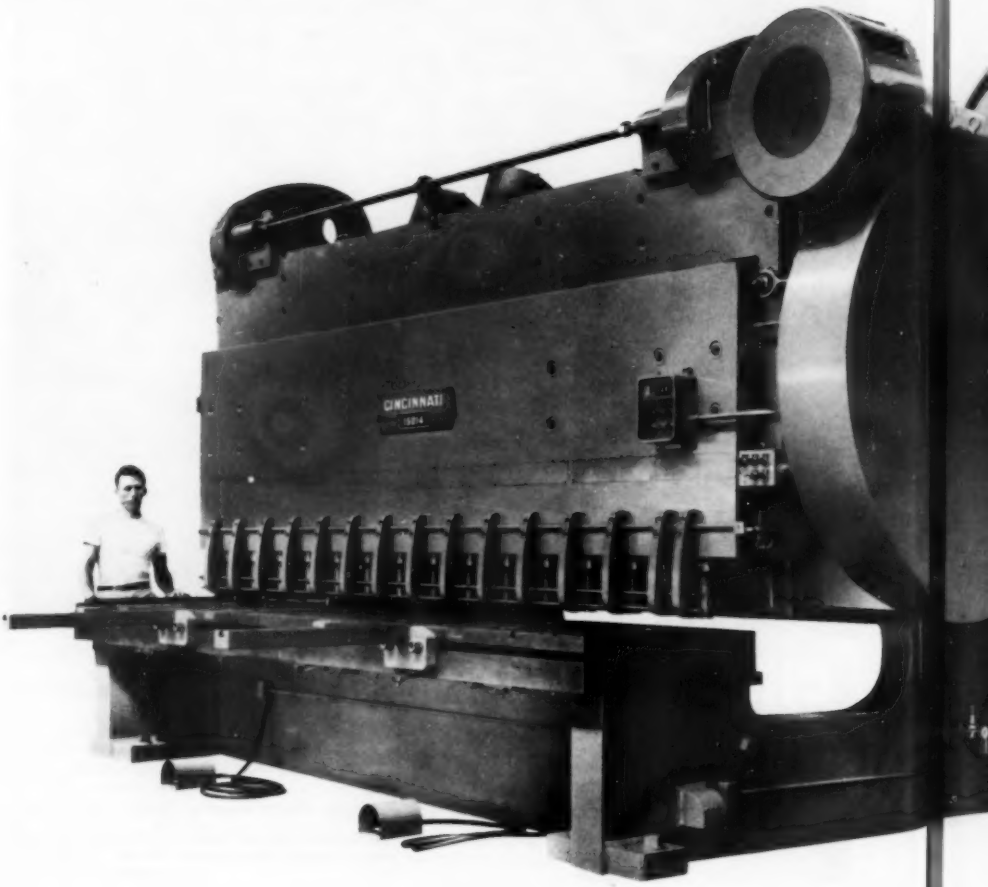
This CINCINNATI®...

1¼ in. thick X



... shears mild steel plate

14 ft. long

This 15014 Series Cincinnati All-Steel Shear has a 36″ gap and a 48″ back gage range.

Power for heavy cutting with accuracy and operating convenience are combined in this machine.

Modern features such as — Hydraulic Holddowns, Front Operated Power Back Gage, Hinged Back Gage Angle, Automatic Pressure Lubrication, All-Steel Interlocked Construction, Forged Alloy Steel Eccentric Shaft—all contribute to an outstanding performance with low maintenance and high accuracy.

See your Cincinnati Representative for either Heavy or Light Shearing Applications. Write for Catalog S-7R.

Shapers / Shears / Press Brakes

THE CINCINNATI SHAPER CO.

Cincinnati 11, Ohio, U.S.A.

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How Ralph Hockett increased diamond wheel life 72%

If ever a man was a perfectionist, that man is Glenn Carr, General Foreman of the Tool Grinding Department at the Wichita Division of the Boeing Airplane Company. And, after fifteen years of working to the kind of tolerances required by the world's leading builder of superbombers, he tends to be skeptical of miraculous claims.

That's why Ralph Hockett of Bay State distributor Wichita Pump & Supply Co., didn't make much fuss about Bay State's new diamond wheels. He analyzed the problem in his usual fact-finding manner, submitted wheels for test and let them speak for themselves.

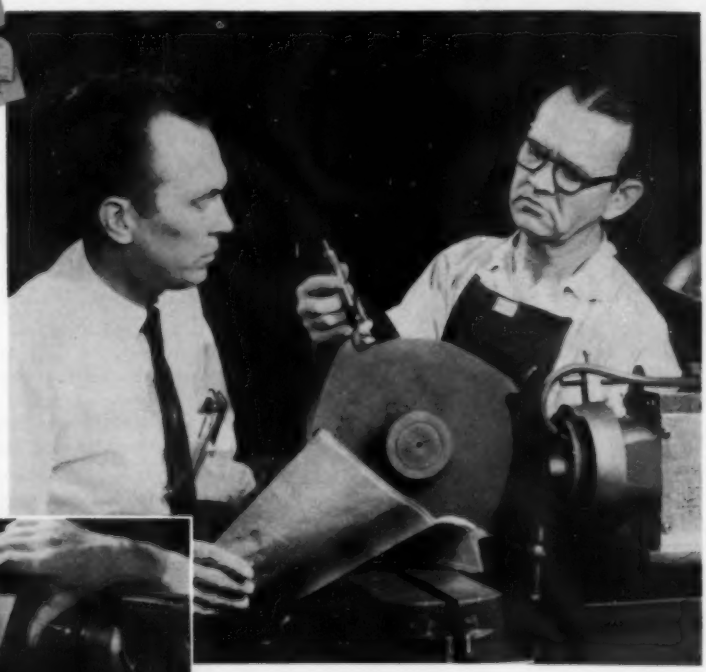
The result was an eye-opener. The pay-off was in wheel life. Against an average life of *125* hours previously, the new Bay State wheels averaged *215* hours per wheel!

One important factor contributing to this bonus wheel life was the use of Bay State's unique BA Resinoid bond.

The Bay State wheels were not only longer-lasting but they were more versatile, cooler cutting and gave a far superior finish. They are now, of course, a regular inventory item at Boeing, Wichita, where B-52 missile bombers are in production for the Air Force.

If you have a diamond-wheel grinding problem, you'll find that your Bay State representative, direct or distributor, is ready to supply the right wheel for the job with either natural or man-made diamond abrasive . . . and he may well be able to give you a significant improvement in performance, too. Better grinding at lower cost . . . that is his business.

This new catalog, which includes pricing data, gladly sent on your request. Ask for Form 217.



Operator Harvey Johnson checks the finish on carbide-inserted tooth of a milling cutter after grinding with Bay State's 215-hour (average life) diamond cup wheel. Glenn Carr, General Foreman, checks Johnson's reading against blueprint.

at **BOEING** WICHITA

You don't get to know the aircraft business overnight and Ralph Hockett is the first to admit that he has never stopped learning. 27 years as an abrasive specialist, with 19 of them servicing Boeing on everything from the early B-17s on up, have given him what you might call a substantial background in the industry.

BAY STATE ABRASIVES

BAY STATE WHEELS of PROGRESS

Bay State Abrasive Products Co., Westboro, Massachusetts.
In Canada: Bay State Abrasive Products Co., (Canada) Ltd., Brantford, Ontario.
Branch Offices: Chicago, Cleveland, Detroit, Pittsburgh, Los Angeles. *Distributors:* All principal cities.

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MOLYKOTE®

LUBRICANT

metalworking news

PUNCH LIFE INCREASED FROM 2,000 to 25,000 HOLES IN STEEL PLATE

These punches (11/16") were used to punch 25000 holes in ¼", 1020 cold rolled steel plate. Without MOLYKOTE Lubricants a maximum life of only 2000 holes could be obtained.

A West Coast manufacturer was experiencing low punch life with the best conventional lubricants. Their multiple punching operation consisted of cold shearing 50 holes simultaneously in a single steel plate. A maximum life of 2,000 holes per punch was obtained with ordinary lubricants.

Then, MOLYKOTE Type G was applied to the punch occasionally. The result: punch life was increased from 2,000 to 25,000 holes which afforded substantial savings.

When writing, refer to Item 508

"A LITTLE BOTTLE FOR A BIG JOB"

- For Extending Die Life.
- For Preventing Metal Pickup.

Try it . . . Order a 10 ounce container of MOLYKOTE Type Z TODAY!

When writing, refer to Item 507

MOLYKOTE CANNOT BE SQUEEZED OUT REGARDLESS OF PRESSURES; EXCELS AS COLD-FORMING LUBRICANT IN METALWORKING

Distortion, Stick-Slip and Fretting Eliminated • Mounting Loads Reduced • Chatter and Noise Avoided • Allows Easier Disassembly

In metal forming the most difficult problem to overcome is scuffing from metal pickup on the dies. Direct contact of bare surfaces of a piece undergoing formation with the die often results in galling, scuffing, etc. If the surfaces can be separated by a lubricant of sufficient film strength, metal pickup does not occur.

Before new dies are used, burnish them with MOLYKOTE Type Z. If the lubricant you are now using does not have sufficient film strength and galling does occur, use MOLYKOTE on your dies.

The automobile industry which forms and fabricates vast tonnages of various metals, uses MOLYKOTE Type Z extensively.

When writing, refer to Item 505

Applying MOLYKOTE Lubricant to feed stock at the Bassick Company, Bridgeport, Conn., in a forming operation.

DAMAGE DUE TO IMPROPER MACHINERY "WEAR-IN" CAN BE ELIMINATED WITH NEW COMPOUND

Wear-in damage is often serious enough to require costly reconditioning of new equipment and if the damage is not repaired, it will interfere with and reduce the useful service life of expensive machinery. During this critical wear-in period, damage due to galling, scoring, tearing, scratching, excessive abrasion and seizing is an inherent hazard. MOLYKOTE WEAR-IN COMPOUND is the most effective lubricant yet developed to combat this damage.

In seven different ways, MOLYKOTE WEAR-IN COMPOUND saves you time and money:

1. **Shortens "wear-in" period without use of abrasives.**
2. **Reduces galling, seizing and excessive wear during the critical "wear-in" period in new or rebuilt machinery and after the installation of replacement parts.**
3. **Offers the best safeguard against costly reconditioning work and shipping delays due to the "breaking-in" of new machinery.**
4. **Eliminates "stick-slip" behavior and resists galling and seizing at bearing pressures far beyond the yield point of any metal.**
5. **Specifically designed for "wear-in" use. MoS_2 particles make intimate contact with bearing surfaces. Will not scrape off.**
6. **Need not be burnished into surface. Brush or wipe on a thin coating.**
7. **Inexpensive . . . a little goes a long way.**

When writing, refer to Item 506

Address your letter to The Alpha-Molykote Corp., 65 Harvard Ave., Stamford, Conn.
Phone: FIreside 8-3724.

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THE ALPHA-MOLYKOTE CORP.
Stamford, Connecticut
Please send me details on

Item 505 ☐ Item 506 ☐ Item 507 ☐ Item 508 ☐

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Company _____
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THE ALPHA-MOLYKOTE CORPORATION

BREAKING LUBRICATION BARRIERS

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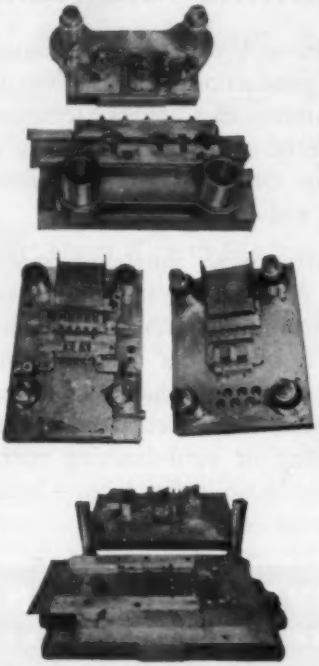
Produced by LATROBE for long-run dies...



Metalmasters

Fully-Uniform . . . Free-Machining DESEGATIZED®

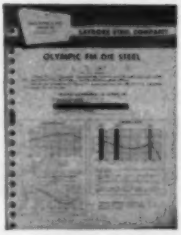
OLYMPIC FM

High Alloy Die Steel

When your die production calls for long-run service . . . and you need a die steel that yields a superior machine finish without tearing—one that has excellent non-deforming characteristics in heat treatment . . . that's the time to use Latrobe's OLYMPIC FM.

OLYMPIC FM is an air hardening 12% chromium (D-2 type) die steel made to exacting standards by Latrobe Metalmasters . . . guaranteed to be fully-uniform in the distribution of wear-resisting carbide particles and alloy sulphides for better machinability . . . a result of Latrobe's exclusive DESEGATIZED® process of manufacture!

There's a wide range of Olympic FM sizes stocked at branch warehouses near you—Call today!



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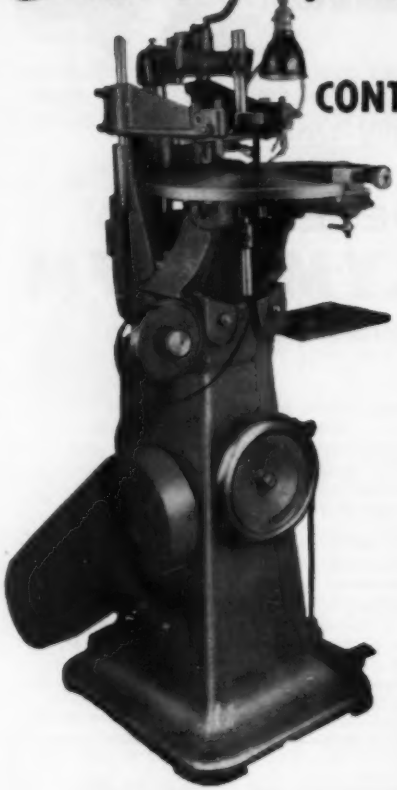
Save Hours in tool rooms and die shops with CONTOUR SAWING AND FILING



You can save real time and money in the production of parts for jigs and fixtures, dies, gages, templates and special machine production by using an Oliver of Adrian contour sawing and filing machine.

The Oliver is so simple to operate that all sawing, filing and lapping can be handled by an ordinary mechanic—saving a skilled die maker's costly time. Parts can be shaped to dimension faster, more accurately with no hand filing or semi-finishing operations. Available in five types – bench or pedestal. Write today.

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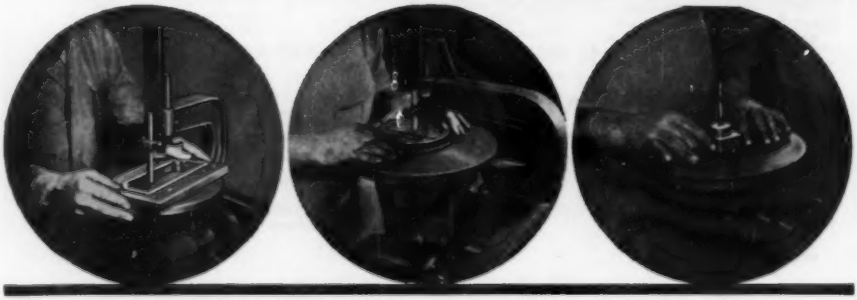

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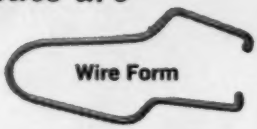
4 reasons why

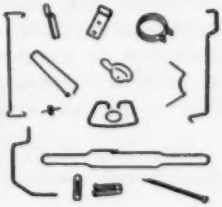
Nilson Automatic 4-Slides are "Universal" Forming Machines



1. Form Wire or Ribbon Metal Stock
2. Accomodate Long or Short Pieces
3. Job Versatility through Quick-Change Cams
4. Combine Stamping & Forming in 1 Machine

SIZE RANGES.
Wire up to ½" diameter
Ribbon stock to 3½" wide
Feeds up to 32"

5 TO 75 TON
PRESS SECTIONS



Every Nilson Automatic 4-Slide is truly a "universal" forming machine, a machine designed to produce either wire forms or metal stampings at high production rates.

Open construction provides easy access to all tooling . . . permits rapid changeover from one stock to the other. And longer feeds, longer slide strokes give a Nilson the built-in ability to handle a wide range of work sizes—without special attachments or accessories.

For real efficiency in your pressroom, just pick the capacity you need from Nilson's 17 models of 4-slides! One of these versatile machines will make your stamping and forming operations faster, easier . . . and more profitable.

Write today for the Nilson General Catalog on Automatic 4-Slide Equipment

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THE A. H. NILSON MACHINE CO.
602 Bridgeport Avenue • Shelton, Conn.

AUTOMATIC WIRE & RIBBON METAL FORMING 4-SLIDE MACHINES • WIRE & STOCK REELS • WIRE STRAIGHTENING EQUIPMENT • AUTOMATIC STAPLE FORMING MACHINES • SPECIAL WIRE FORMING EQUIPMENT

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PARTS FEEDERS

Cut costs—increase production reduce manual inter-process parts handling

SYNTRON Transfer & Storage Parts Feeders provide an automatic link between process operations. They automatically receive, store, orient and discharge parts at a controlled rate from one operation to another. Parts may be received at one level and discharged at another—conveyed either up or down spiral as desired. Rate of parts flow is instantly controllable to operational demands.

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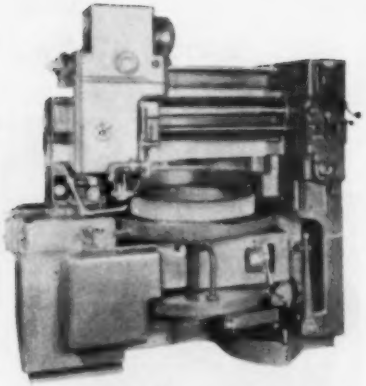

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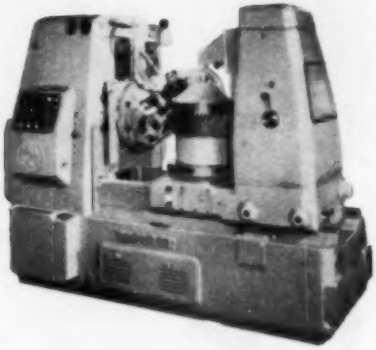
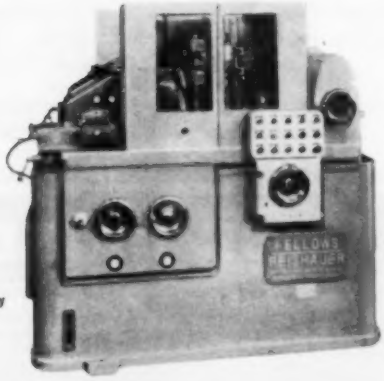


Pfauter Gear Hobbers... up to 120" capacity



No. 12 Fellows-Reishauer Gear Grinder... up to 12" capacity

ONLY FELLOWS OFFERS ALL 3 MACHINES!

WHATEVER YOU NEED for modern gear productivity, Fellows has the equipment to keep you in the competition!

In addition to Gear Shapers, and all other Fellows equipment from cutters to inspection instruments, Fellows now sells the No. 12 Fellows-Reishauer Gear Grinding Machine and the complete line of world-famous Pfauter Gear Hobbers!

Fellows Gear Shapers and Pfauter Gear Hobbers provide outstanding accuracy and high production speeds, on short runs as well as long runs, for a wide range of gears up to 120" P.D. On all but the larger units, a wide range of attachments is available for semi-automatic or fully automatic operation. Runout tolerances measured in tenths, produced at production line speeds, are the special province of the No. 12 Fellows-Reishauer Gear Grinding Machine. Simple, fast set-up permits economical grinding of single gears as well as long runs in sizes up to 12" O.D.

Ask your Fellows Representative about the complete line of gear production and inspection equipment. Just write or call any office of

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Four reasons why you get greater accuracy and uniformity of tapped holes:

1. EXACT FLUTE SPACING
2. UNIFORM FLUTE CONTOURS
3. PRECISION CHIP-DRIVER CONTOURS
4. ACCURATE AND CONCENTRIC CHAMFERS

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SPECIAL TAPS

Modern "exotic" alloys are typical of the wide variety of unusually hard, soft or stringy materials in use today that make your tapping operations more difficult than ever before. When it's no longer practical or possible to use conventional taps—when it's time to call in a specialist—Winter is at your service.

Winter has the experience to recommend and supply the right tap for your individual requirements. Among the many types of Winter Special Taps always available from stock are Multi Taps for aluminum, magnesium and stainless steel; Oversize Taps for plastics; Helical Fluted Taps; Nib-type Taps and Fluteless Spiral-Pointed Taps.

CALL YOUR DISTRIBUTOR for standard and special WINTER Balanced Action Taps, Dies, and Gages.

WINTER BROTHERS COMPANY, Rochester, Michigan, U.S.A. Distributors in principal cities. Branches in New York • Detroit • Chicago • Dallas • San Francisco • Los Angeles • Division of National Twist Drill & Tool Co.

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ELIMINATES WEB-THINNING OPERATIONS—National self-thinned heavy-duty drills have the thinning operations built into the flute contour. They are particularly effective in drilling tough metals with hardness above Rockwell C-30.
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YOU GET THE MOST IMPORTANT INGREDIENT FREE

Many of the competitive advantages of cost-cutting with National tools are obviously the product of fine materials, skilled workmanship, modern production equipment and processes, and long experience.

But there's another very important ingredient—one you get only in National tools. It's *on-the-job efficiency* resulting from National's continued search for better ways to cut modern metals. It's free—and it's an in-built value of every National tool you use—self-thinned twist drills, gun drills, counterbores, expansion reamers, end mills, milling cutters and other "Research Improved" tools.

CALL YOUR DISTRIBUTOR for NATIONAL twist drills, reamers, counterbores, milling cutters, end mills, hobs, carbide and special tools.

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This roll looked perfect...

until SUPERFINISH revealed these defects!

Everybody said it was as perfect a finish as you'd ever see. A 12" steel roll ground down to a smoothness of less than 2 micro inches—dazzlingly reflective from end to end. Not a visible defect *—on the surface.*

But when SUPERFINISHING began, some interesting marks appeared—longitudinal flat spots—defects produced by the prior operation and then covered up by the heat of grinding.

SUPERFINISH brings these hidden troubles out in the open—out where you can see them and recognize the cause. And if your troubles are not too serious, SUPERFINISH can correct them economically and fast.

If you have fine finish requirements it will pay you to write for our new Superfinish Catalog.

MASTERLINE GISHOLT SINCE 1887 GISHOLT

GISHOLT MACHINE COMPANY
Madison 10, Wisconsin

ASK YOUR GISHOLT REPRESENTATIVE ABOUT GISHOLT FACTORY-REBUILT MACHINES WITH NEW MACHINE GUARANTEE

T-J

LAUNCHES A NEW CUTTING TOOL LINE FOR MILLING ACCURACY

For precision milling to close tolerances, so vital in today's high-speed, high-production manufacturing, T-J now offers a new, improved line of milling cutters. The new cutter line features a high helix angle, double back-off, and a right-hand spiral to produce more and smoother cuts between grinds, and a free-cutting, stronger tool.

Specially designed and precision-manufactured for die sinking and production milling, the new line is designed to include flats on the shanks for set screw type drivers on all of the end and side milling cutters. Write today for complete information to the Tomkins-Johnson Company, Jackson, Mich.

Ask for completely new cutter catalogue No. 259.

T-J TOMKINS-JOHNSON

RIVITORS · AIR AND HYDRAULIC CYLINDERS · CUTTERS · CLINCHORS

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when will this cutter need GRINDING?

When the blades get dull, of course.

But when is a cutter blade dull? At what degree of dullness does it begin to consume increasingly more horsepower and produce inferior finish? At what point does grinding prolong blade life?

Knowing *exactly* when to grind cutters is just one of the many variables that vitally affect performance and costs.

Our specialty is working with these variables—to furnish the most economical solutions to milling and boring problems, including grinding techniques, through the use of inserted blade cutters.

We study machine, work piece, feed rate, depth of cut, speed and finish requirements. And only after pooling this information with the customer's specialized knowledge of his own work is any cutter recommended.

We would appreciate the opportunity to tell you more about this unique cutter selection service. Write:

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This helpful new booklet tells you how to reduce the cost of chips and improve your milling and boring performance. Ask for a free copy of booklet No. 68E.

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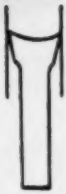
FIGHT FRICTION . . .

GIVE YOU LONGER BLADE LIFE

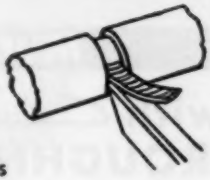


1. T-SHAPED BLADE . . .

provides liberal side clearance that eliminates excessive friction.

2. HOLLOW-GROUND TOP . . .

causes chips to collapse thus relieving friction against sidewall of cut.



3. COOLER OPERATION . . .

collapsed chips are drawn away from sidewalls permitting coolant to reach blade cutting edges.

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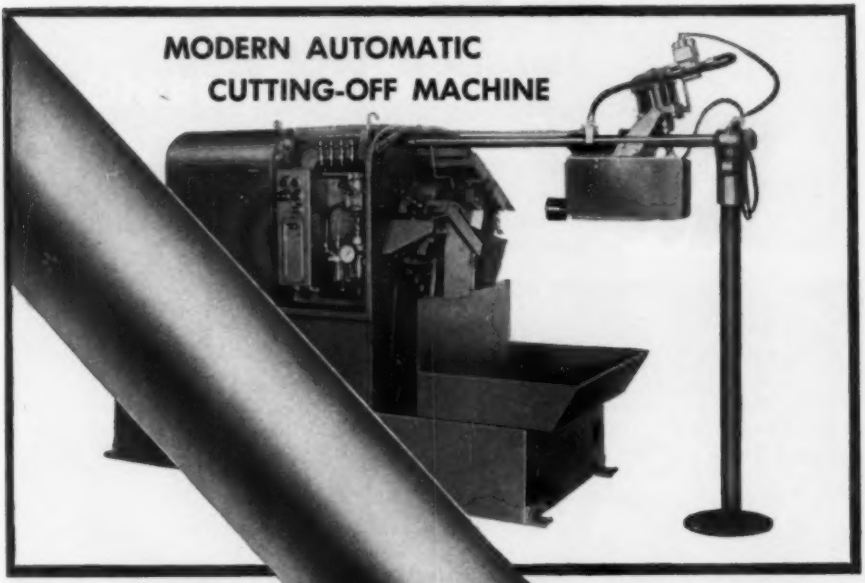

Fast cut-off in lengths from a fraction of an inch to several feet with micrometer accuracy. Handles any length of stock and cuts any material that can be turned—bar stock up to 3" O.D.—tubing up to 8" O.D. Will cut-off, form, groove, flange and chamfer in a single operation—at a high rate of speed.

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Job Applications

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A new type of cut that produces a tooth form with three cutting edges on each tooth has many advantages over conventional Diamond Cut burs.

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By carefully controlling depth of flute, both left and right, and by engineering a definite ratio between the number of left and right flutes, a revolutionary bur cutting action results.

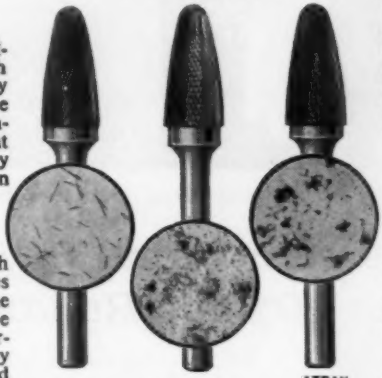
3 CUTTING EDGES

The chisel shaped tooth with three cutting edges produces a flake-like chip instead of the hard-to-control sliver-like chips produced by cuts ordinarily supplied on burs and the gritty, abrasive chips formed with the pyramidal type tooth on most Diamond Type cut burs.

LONGER TOOL LIFE

Cutting action is faster and more positive and tool life is longer even though this new type of cut has been shop tested on, and is recommended for cutting the toughest heat treated alloys and stainless steels.

Fine Cut bur (left) produces long sliver-like chips. Diamond Cut bur (center) produces sharp, abrasive chips. Atrax Dia-Mo Cut (right) produces flake-like chips—gives faster, smoother cutting action.

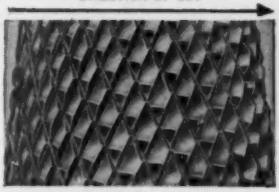


FINE CUT DIAMOND CUT ATRAX DIA-MO CUT

IMPROVED SURFACE FINISH

Surface finish after burring with the new Atrax Dia-Mo Cut is superior to that produced by a Diamond Cut bur

DIRECTION OF CUT



DIA-MO CUT

DIRECTION OF CUT

DIAMOND CUT

making subsequent finishing, grinding and polishing operations much easier.

It is recommended that the new Dia-Mo Cut be operated at 1/3 to 1/2 the speed of conventional burs for most efficient cutting action and uniform surfaces.

The new Atrax Dia-Mo Cut is available on request on 615 different bur sizes and types in standard, fine and coarse cuts.

NOTE three cutting edges take shearing-type cuts producing smooth surface finish

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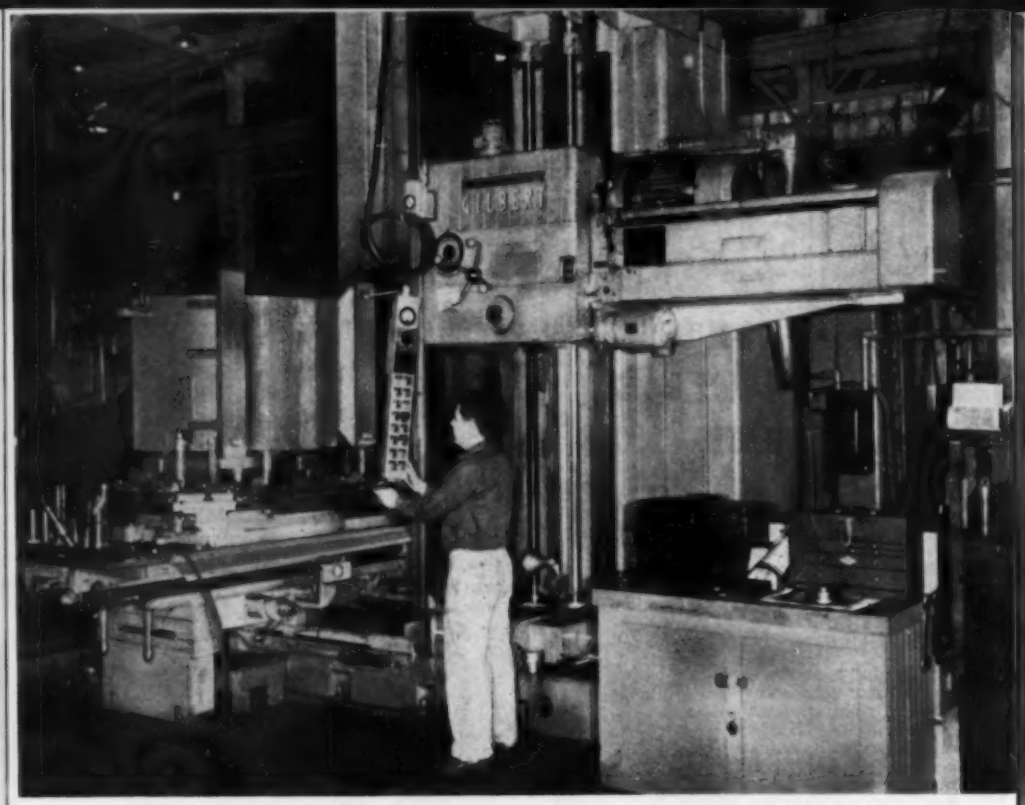

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"This 5" Gilbert is saving us approximately 20% on setup and 20% on operating time on motor frames," reports W. R. Henninge, Methods Engineer at The Reliance Electric and Engineering Co., Cleveland.

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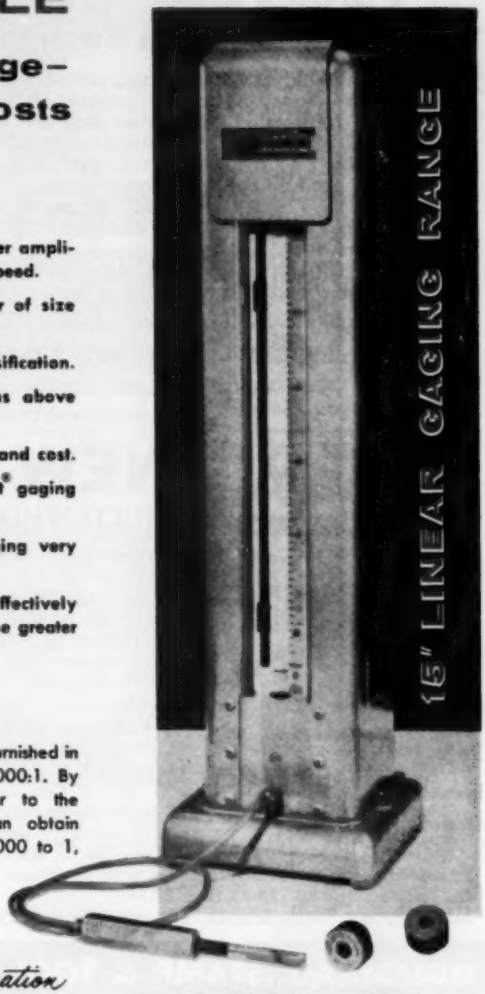

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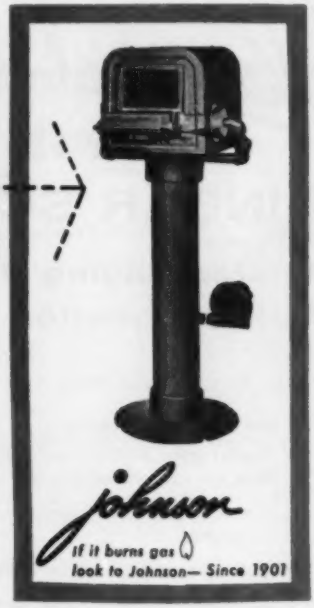

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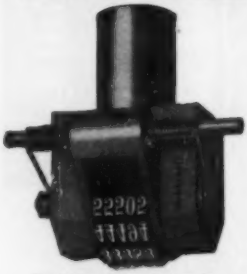

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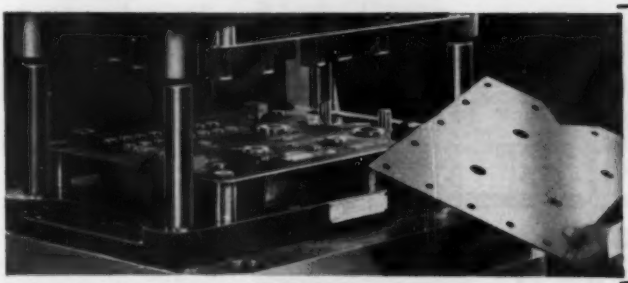

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features in this issue

PRODUCING A TAPERED STEEL SHELL—A large quantity of 0.2% carbon steel shells from sheets 0.125" to be produced in a hurry posed several problems for an English firm. The author, W. Walker, takes you through each operation and credits the inspection department with exercising strict control at all stages of the press-working operations. .....**Page 103**

CREATIVE ENGINEERING—Stiction, or "stick-slip," is one of the major problems of sliding one surface over another. Harry Conn tells you what it is and how it occurs in machine tool way movements. Taking over the "Process Engineering" department this month, Allan Young stresses the importance of proper preparation and presentation of the tool cost estimate. In "The Practical Diemaker" for this month, Paul Prikos presents some principles for estimating form dies for "U" and "Z" brackets. L. P. Sohles answers the question, "How Much Lip Relief for Drilling?" .....**Pages 79 to 100**

HANDLING A "SLOWDOWN"—In his windup article of his current series of 12 installments of "Practical Arbitration, Time Study and Work Simplification," Harold Nissley relates the experience of one company in handling a slowdown perpetrated by 21 veteran workers who were transferred to a department producing a new power tool. Here's a case where the company's own personnel succeeded in doubling production in a 21-man department without the help of industrial engineers or consultants. .....**Page 110**

FACING WITH CERAMICS—Twin Disc Clutch Co. in Rockford, Ill. was interested in acquiring a good enough surface finish on several facing operations to eliminate grinding. Early tests with ceramic tools were discouraging, but today company engineers are happy with results achieved in surface finish, tool life and the elimination of grinding. .....**Page 114**

MULTI-PURPOSE TOOLING—To "trim the fat" from your tooling budget it is wise to consider the multi-purpose approach. Clement F. Brown, a production and methods engineer, offers a check-list to enable you to evaluate the possibilities for functional, multi-purpose tools. He also takes you step-by-step through a couple of examples of multi-purpose tooling developed for two similar parts where milling is the major operation. .....**Page 121**

NEWS OF AUTOMATION—When it was decided by Ford Motor Company top management to produce the six-cylinder Falcon engine at the Lima Engine plant, the big problem was to change an eight-cylinder engine line to Falcon engine production. The changeover was accomplished in approximately 12 months. .....**Page 127**

ELECTROLYTIC CAVITY SINKING—The new Anocut machine applies electrolytic principle to the sinking of irregular holes and shapes, following the contour of an electrode made for the purpose. .....**Page 133**

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seen and heard in industry

2

By **William F. Schleicher**
Vice President, Editorial Director
Hitchcock Publishing Co.

● "Service costs can cut sharply into sales of many of our American products," Ed Boots, who is chairman of the board of the Nylok Corp., told me recently. "The average young couple getting started in life often finds the burden of service costs too heavy after the first year of use. This is getting worse instead of better. If all of the best technical facilities were thrown into the design and manufacture of a product it is conceivable, theoretically, that it would never wear out. Unfortunately, too many manufacturers think it is cheaper to save a penny and let the consumer spend $50 a year to keep it running. This false economy will make it easy for foreign products, many of which are better built than our own, to get a foothold in markets so far untouched; it will force a consumer to keep his old products longer than he should because he's spent his original purchase price all over again putting it into shape. He will not trade it for a unit which will cause him grief and money before he gets trouble-free operation again.

"To lay the blame for this on any one member of the team is silly. There are too many splendid engineers who want to produce a serviceable product. Too often their ideas take a back seat to ridiculous buying habits. Let me illustrate: many companies shop around and haggle with fastener suppliers until they get the lowest possible price. When they get the fasteners onto the assembly floor they suddenly find that it costs ten to a hundred times as much to assemble the products as it would have cost had they spent a few pennies more at the outset. The few pennies of additional original costs would have saved them thou-

sands of dollars in assembly costs, to say nothing of the saving in service costs and the better over-all quality of the product."

• A plant expansion of the Deutsche Norton Gesellschaft, Norton's West Germany facility, has just been announced. Simultaneous with it came news of the retirement of Otto Schutte, who managed the German plant. On our last visit to Germany we spent a delightful hour with Herr Schutte. He came to the U.S. in 1924 to study tooling and machine tools, joined Norton, and in 1928 accepted the post as sales engineer at the German plant. He retires after 33 years of service to grinding and grinding problems. At our meeting, we queried him about a graphite wheel which had come to our attention at the Hannover machine tool show. "The graphite wheel is really nothing new," he said, "back in the twenties it made its appearance in Berlin and has spasmodically popped up from time to time. The wheel actually contains no grit, is resinoid bonded, and is used as a finishing wheel, removing about 3 microinches at a time. Actually, it does no cutting, but merely smoothes the rough surface left by the previous grinding operation. It delivers a fine finish but leaves the work blackish. Rub your hand over it, you'll look like a coal miner. The wheel has value, although I'm not sure but what other wheels do just as well."

We queried Herr Schutte about a centerless grinder which was shown at the show at that time. "You refer," he said, "to the old Detroit grinder—I don't remember who first came out with it—but it, also, is old. On this type of centerless the wheels, instead of being in a horizontal axis, are in a vertical axis. Frankly, this principle has been investigated in the U.S. and I suppose, because no one is manufacturing it, is not found to be superior to standard centerless grinding machines. Yet, it may prove to be the answer to many problems. It is interesting to note how many ideas are developed, discarded and thrown into history, only to have someone come up with it again and quite frequently make a go of it. He may have found the solution to some of the bugs which were in the original design. There really is nothing new under the sun. Everything appears to be a different arrangement of concepts around a sound basic premise."

We wish Otto Schutte a happy retirement after a lifetime of service amidst hectic events.

Incidentally, the German plant is one of the leading abrasive companies in Europe. Manufacturing area of the plant has increased seven times in the past 50 years; its employees have grown from 100 to 600. It is the oldest of Norton's overseas plants.

• During the remaining weeks of this year we will be thinking more about doing things for the betterment of mankind. If we could only keep this Christmas spirit alive during the new year and the years that follow, 1959 would be the merriest Christmas in over 1900 years. Better that we could look ahead to the blessed 'sixties rather than the touted fabulous 'sixties. With this thought, I wish you a truly Merry Christmas and a happy 1960.

373-B

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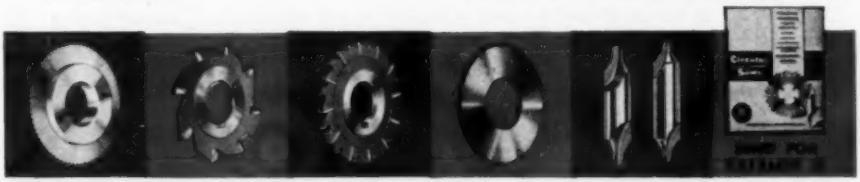

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For almost two thousand years men have sought to develop a formula for peace. But greed for power and total conquest have defeated their efforts. The wreckage of the last quarter century shows that great advances in science have only increased the havoc.

In 1959 we see nations seeking to gain superiority through atomic weapons, missiles and scientific achievement. Claims are being made for outer space. But He whose star shone that eventful night is still the ruler of the universe.

We believe that Jesus Christ came to this earth bringing and proclaiming—not a new religion or a revised religion—a way of life. A way of life that brings peace and joy and happiness to each one who follows it. For the peace proclaimed by the angels is peace for the individual. It was not a promise to all mankind that wars would cease. The promised peace is only for those who accept this Babe of Bethlehem as the Son of God, and follow His way of life.

And His way is a life of service. It begins with understanding this command: "Thou shalt love the Lord thy God with all thy heart, and with all thy soul, and with all thy mind . . . and thy neighbor as thyself." (Matthew 22:37)

The answer to the great problems of today is not in war or demonstrations of power, but in using our scientific advancements for the betterment of mankind. Ours is the responsibility in everyday living to carry on for a better world by keeping Christ's principles.

The history of the world has been one of hate, greed, jealousy, envy and a desire to be first. Unless we are willing to have the spirit of Christ in our hearts, there is small likelihood that the future will be very different.

At the birth of Christ, light was given which no darkness can extinguish, nor scientific accomplishments dim. Let us walk in that light. It will then be a truly Merry Christmas and a blessed and prosperous 1960.

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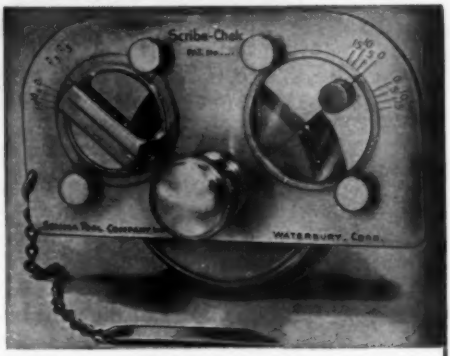

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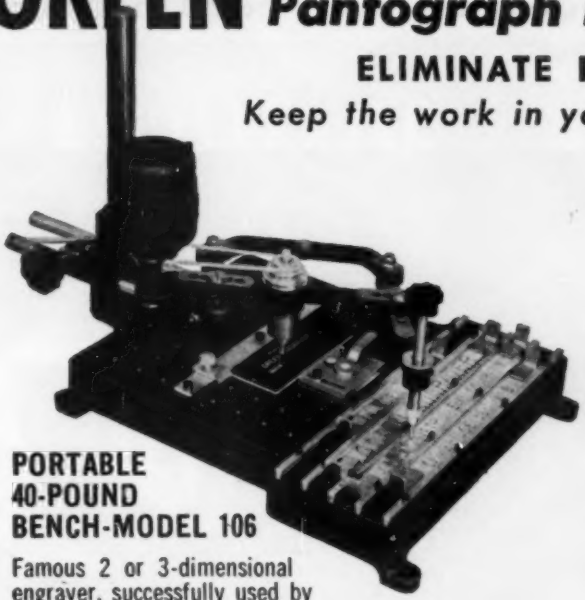

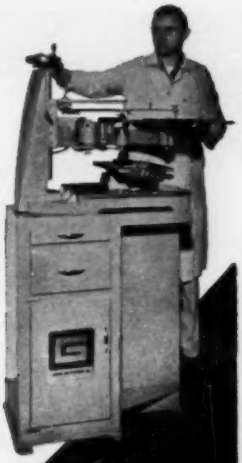

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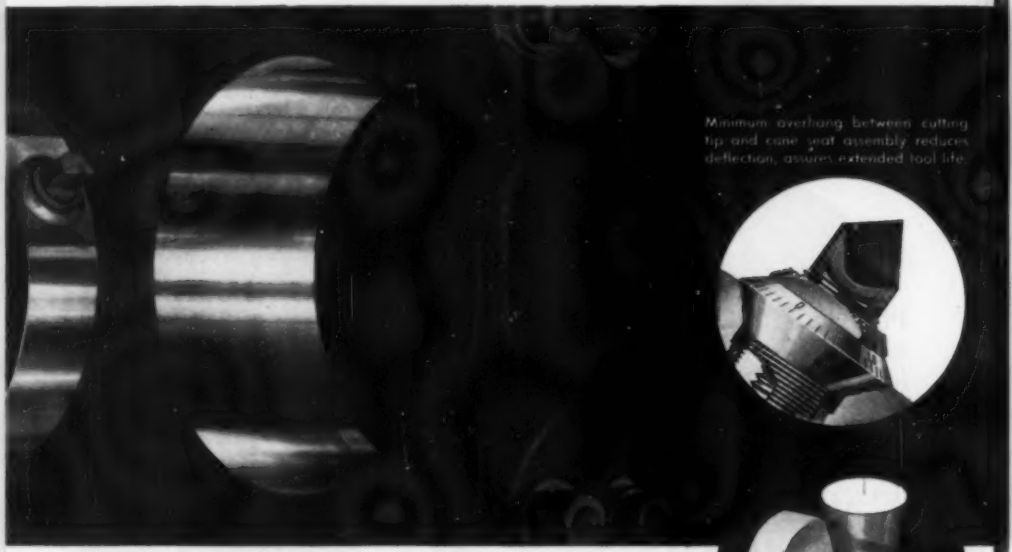

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ENGINEERING and TOOLING

STICTION—What It Is and How It Occurs in Machine Tool Way Movements

■ The phenomena of stiction has much in common with friction. They can both be very valuable and beneficial or they can be very destructive and perpetuators of many mechanical difficulties.

Stiction, commonly called "Stick-Slip," is one of the major problems of sliding one surface over another. It is a matter of almost common experience that the sliding of a body over another under a steady pulling force proceeds sometimes at nearly constant or constant velocity, on other occasions at velocities that fluctuate widely. All stick-slip processes are caused by the fact that the friction force does not remain constant as a function of some other variable. The other variable may be distance, time, velocity, normal force, and each produces a form of oscillation.

Stiction causes such noises as creaking, squealing, chattering. Without it a violinist could produce no music, and he must promote it by rosining his bow. In most instances stick-slip is a nuisance, but on the other hand the squeaking wheel gets the most grease or money.

The purpose of this article is to show how stiction occurs in machine tool way movements. When it occurs in machine tools it is detrimental to cutting tool life, finish of workpiece, complicates the problem of

automatic positioning and, last but not least, it causes wear. This is perhaps the least understood phenomena in the science of metal cutting.

Stiction cannot be understood or analyzed unless you are aware that the third law of friction is not a law. In fact, many things taught concerning friction 50 years ago have since been found to be erroneous. As an example, it formerly was taught that we should not mistake friction with adhesion because friction was not affected by adhesion. Today it is common knowledge that friction arises from the adhesion of molecules in the surfaces in contact with each other. The bond between the surfaces becomes so strong at some points (or asperities) that tiny fragments are torn off one and stick to the other.

The third law of friction says that when one solid body slides over another, the frictional force is independent of the sliding velocity. It has been known for some time that friction is not independent of sliding speed. In fact the coefficient of friction between two bodies may vary as much as 30 to 50 percent according to the speed of motion.[4]

Today we know that the frictional force resisting the start of sliding for two bodies at rest is obviously greater than the resistance after they are in motion for the most commonly used materials. Therefore two coefficients are neded: one for *static* such as surfaces at rest and a *kinetic* one for surfaces in motion.

Today we know that both the kinetic and static coefficients vary. The kinetic drops off as the sliding

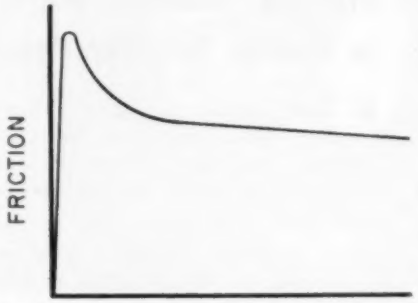


FIG.1

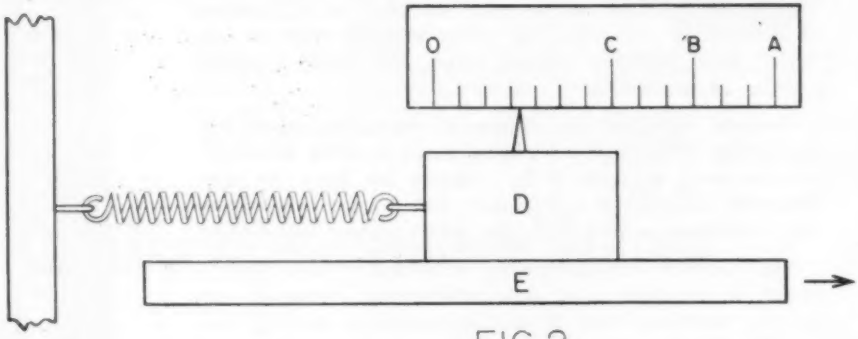


FIG.2

speed reaches a certain velocity. In other words at slow velocities the friction increases with the velocity until a definite speed is attained; then the friction begins to steadily diminish as shown by the negative part of the slope in Figure 1.

Static friction is dependent to some extent on the time the surfaces have been in contact.

The only completely satisfactory way to represent the friction coefficient for any pair of surfaces is by two plots, one of the static coefficient as a function of time of contact, the other of the kinetic coefficient as a function of sliding velocity.

It is the breakdown of the third "law" of friction—the variation of frictional force with velocity—that causes stick-slip or stiction. This phenomenon we shall now consider and explain by use of the apparatus shown in Figure 2.

Suppose we attach a block D to an anchored spring and place it on a longer slab E which we set in motion at a slow speed. At first the block D is dragged along on the moving slab; it will not be held back by the spring, therefore it slides on the slab, until the springs pull is equal to the static coefficient of friction. The pull of the stretched spring reaches that value when the block arrives at the point A (of Figure 2). Now the block begins to slip on the moving surface. As soon as it does, the lower kinetic coefficient of friction takes over, and the block slides rapidly toward the left. When it has moved back to point C, it comes to rest. Here the higher static coefficient takes charge, and the block again sticks to the surface and is dragged to A. Then it slips back

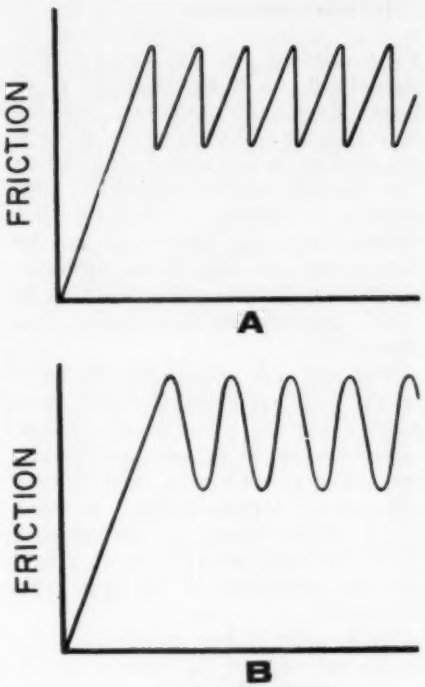


FIG. 3

to C. This is a simple laboratory demonstration of the stick-slip phenomenon, so named in 1939 by Bowden and Leben at University of Cambridge.[4]

The writer has performed the same experiment by pulling a steel block with a spring fastened to a lathe carriage and a pointer also fastened on the carriage aimed at the middle of the steel block.

At the point B on the scale, half way between points A and C, the pull on the spring is equal to the kinetic coefficient of friction. If the static coefficient were the same as the kinetic, the block would be dragged to this point and then stay

there, sliding on the moving slab beneath it. As it is, the block oscillates about this position, sticking and slipping. The situation is complicated by the fact that during motion the friction coefficient varies with changes in sliding velocity, but whether stick-slip may occur can be determined in any given situation simply by observing the direction in which this relation is changing, see Figure 1.

You may ask what does this have to do with machinery? Very few mechanisms in use contain sliding surfaces attached to springs. The answer is that whenever solid bodies are pressed together, there is some elastic displacement or deformation of the material, resulting in an effect like the operation of the spring in Figure 2.

Stick-up at a low steady velocity results in a curve like that is shown in Figure 3A. The sloping sections of the curve are stick; the vertical sections, slip. At a higher steady speed the stick-slip traces the sinusoidal curve in Figure 3B.

The data shown in Figures 3A and B represents the dotted lines portions shown in Figure 4. Each solid line in Figure 4 is preceded by two dotted lines that converge into the solid line. The dotted lines are the areas or velocities where stiction occurred and shows the friction coefficent fluctuations which cause the phenomena.

Machine tool ways are usually designed to work satisfactorily within definite normal force limitations. The loading on slideways is usually expressed in terms of the total load divided by the bearing area, and common values range from 10 lbs. per square inch to 80 lbs. per square inch.[3]

The graphs in Figure 4 show the effect upon stick-slip and kinetic friction that velocity, finish of surfaces, unit loading, lubrication has and the velocity at which stick-slip disappears. The stick-slip disappeared in these experiments at velocities indicated by the converging of dotted lines into solid lines, but the tiny arrows indicate the kinetic friction and velocity at which all traces of vibrations disappeared.

The upper slideway would be the lathe carriage, milling machine table, planer table, etc. and the lower slider represents the lathe bed, planer bed, etc. It should be noticed that the conventional scraped surfaces show the highest friction forces and the most stick-slip. The best combination is for the upper slider to be cup ground and lower slideway periphery ground.

The lubricants used for the test were straight mineral oils having viscosities of the following approximate values:

1. 100 Redwood I secs. (70° F). L_1
2. 500 Redwood I secs. (70° F). L_2
3. 1500 Redwood I secs. (70° F). L_3

The three different lines in Figure 4 correspond to the lubricants used in the experiments. The main effect due to lubricant viscosity was that stick-slip existed up to a considerably higher velocity with the lowest viscosity lubricant than with the two heavier oils. The heavier oils show better damping characteristics.[3]

It can be seen by examination of the curves in Figure 4, that all curves appear to have a similar form consisting of a descending portion in the region of boundary and mixed lubrication,

followed by a slow ascent as full hydromatic lubrication supervenes. This would tend to confirm De Hart's concept that fluid-film friction can be higher, equal to, or less than dry sliding friction.[3]

It can be readily seen that stiction occurs at the lower velocities which cause trouble in numerical control positioning when nearing the exact predetermined location, also causes vibration or chatter configurations on workpiece and shortens tool life. When stick-slip occurs it can increase

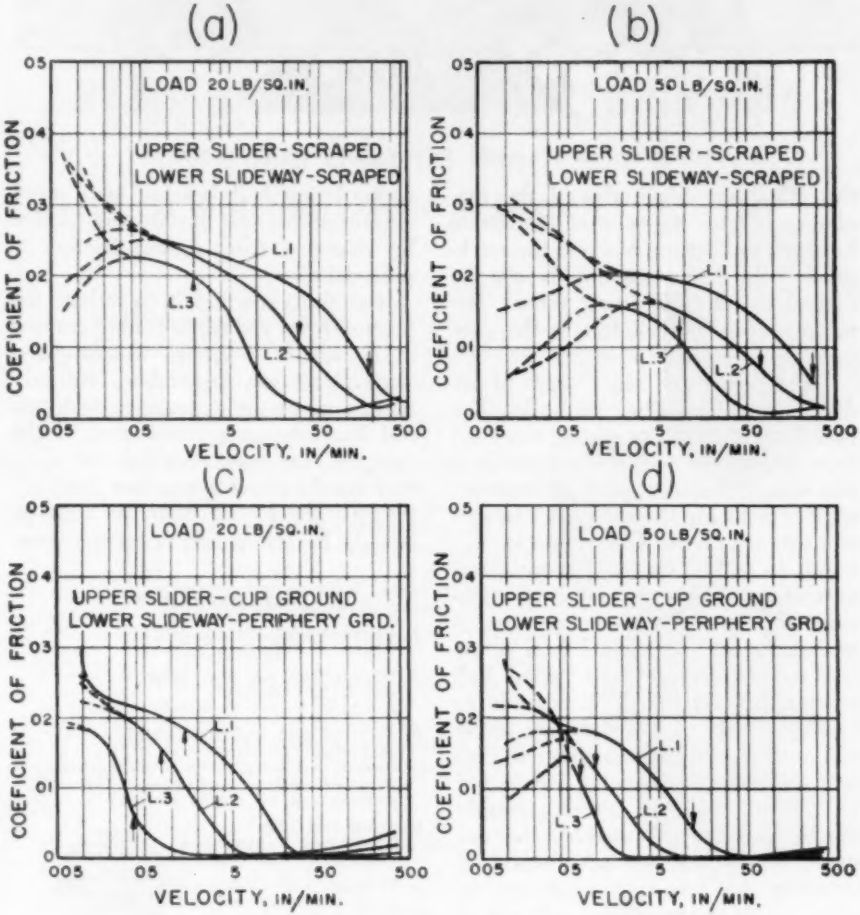
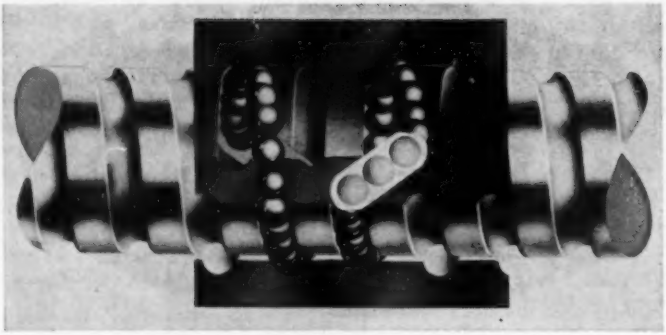


FIG. 4

Courtesy D. F. Galloway, Production Engineering and Research Association of Great Britain.



5. Recirculating ball screw—one method of reducing "stick-slip."

the vibratory amplitudes of the machine and also the relative amplitude between the cutting tool and the workpiece, which in turn builds up the magnitude of the cutting force.[6] The machine thus contributes to the progressive increase in chatter.

There are three main ways of reducing or eliminating stick-slip. The first is to change the sliding velocity; in most cases it will mean increasing the sliding velocity and in rare instances reducing the velocity. The second way is to reduce the stored energy (such as in the spring) whose intermittent release is the cause of stick-slip. This may be done by using a more efficient mechanical lead screw and nut which are now called ball bearing lead screw. It is possible to have stick-slip in the ordinary screw and nut assembly due to about 45 percent of the torque being dissipated in friction. The lead screw assembly shown in Figure 5 enables the designer to use our second method of reducing the leap-frog tendency. In other words, increase the stiffness of the drive and also improve the damping in the system when possible. The recirculating ball bearing lead screw is another example of reducing friction by changing from sliding friction to roller friction.

The third method is to reduce the friction from sliding to rolling friction as outlined in "Friction," *Machine and Tool Blue Book*, September, 1959 edition or go to the expense to maintain full hydrodynamic lubrication of the surfaces. Or find material for ways that would show a positive friction/velocity curve, but then the concept of static friction would be meaningless.

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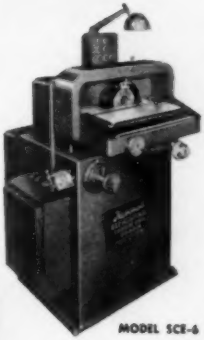

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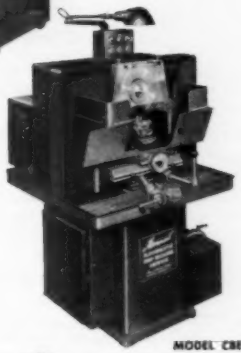

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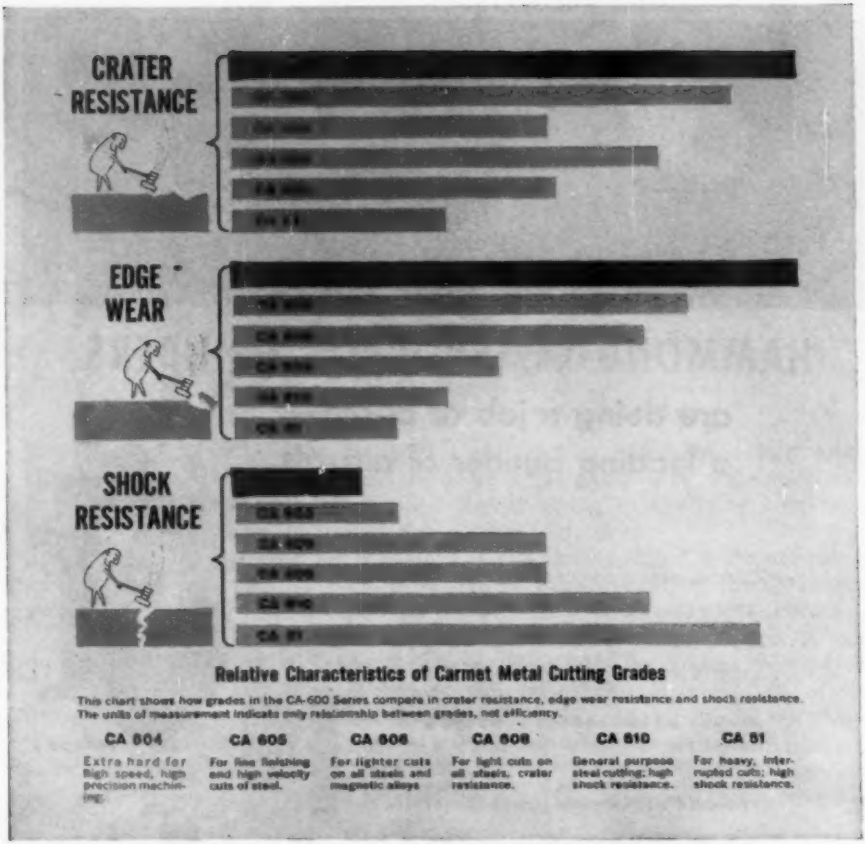

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CA 604	CA 605	CA 606	CA 608	CA 610	CA 51
Extra hard for high speed, high precision machining.	For fine finishing and high velocity cuts of steel.	For lighter cuts on all steels and magnetic alloys	For light cuts on all steels, crater resistance.	General purpose steel cutting; high shock resistance.	For heavy, interrupted cuts; high shock resistance.

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Super-hard cemented carbide designed for today's high-speed, high-precision machining of steel

Product of Allegheny Ludlum research, CA604 is now added to Carmet's crater-resistant 600 series. It is an ultra-hard tungsten carbide with unusually high crater-resistance, wear life and high strength at elevated cutting temperatures. CA604 is an outstanding performer in the fast cutting ceramic areas, combining high velocity finishing with light to medium feeds.

CA604 is offered in Indexable Inserts and Blanks by your Carmet distributor. He carries Carmet standard tools, holders and Indexable Inserts in stock and assures prompt delivery. Call him for help in selecting the proper grades and styles for economical machining—or write *Allegheny Ludlum Steel Corporation, Carmet Division, Detroit 20, Michigan.*

Write for New-Revised CATALOG C-16-B
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ALLEGHENY LUDLUM STEEL CORPORATION

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By **Allan Young**
Collins Radio Company

4

PROCESS ENGINEERING

CREATIVE ENGINEERING

THE TOOL COST ESTIMATE— ITS PROPER PREPARATION AND PRESENTATION

■ An estimate of tooling costs for a particular piece of equipment, properly presented, not only gives cost analysis people the necessary information to aid in pricing the equipment, but can serve as a guide in planning and processing the equipment for manufacture. Thus it becomes very important for the tool estimator to be aware of shop load conditions, processing techniques, and delivery possibilities by various tool vendors, as well as his own toolroom. He must also be able to somehow predict the condition of the tooling market at the prescribed build dates of the subject equipment. Since the estimate of tooling costs closely follows the pre-release review as the next step in the progression toward producing for sale a particular piece of equipment, it becomes obvious that the tool estimate should very well be a guide to all future processing until the equipment is finished.

Tool processing is based on the type of tooling estimated; operations charts are based on the type of tooling processed. The fabrication estimate for the equipment, based on so much shop time and so much material cost, is tied in directly to the tooling estimated.

It seems imperative, therefore, that a tooling estimate not only give a basic cost for tooling the specific equipment, but should also fill in all the background material

available and state all expected contingencies in relation to the tool program.

Fig. 1 shows a sample part-by-part tool estimate sheet. This sheet consists of several columns listing necessary information on tooling costs for each part, a line at the bottom showing equipment type, and any other hand-written information that is necessary to complete the estimate. The first and second columns furnish the part number and nomenclature, and the third column lists the tool or tools which the estimator deems necessary to fabricate each part. The fourth and fifth columns indicate the number of hours estimated to build each tool and the cost if it were built in the company's toolroom. Note that total cost of time and material appear under the cost column, while the only breakdown shown is for internal hours only. This is because material is usually readily available, while shop time is not. This figure helps both the estimator and the process engineer to determine which tools should be built internally and which should be purchased. The

1. Part-by-part tool estimate sheet.

B/R 6080
TOOL COST ESTIMATE SHEET
BUILD QTY — 2500

PART NUMBER	PART NAME	TYPE TOOL	INTERNALLY TOOLED HOURS	INTERNALLY TOOLED COST	TOTALLY PURCHASED TOOLS PURCHASE COST	CODE I or P	SHEET 1 OF 1 REMARKS
30 1000 002	CHASSIS	PC & BLK. DIE	60	300	600	P	
		PC. DIE	42	210	420	P	
		DR. JIG	24	120	240	P	
1001 003	PLATE — FRONT	DR. JIG	35	175	350	I	
		SILK SCREEN		12	24	I	
1002 002	SPACER	NO TOOLS					
1003 004	WRAPAROUND	PC. & NOTCH DIE	54	270	540	P	
		FORM DIE	48	240	480	P	
1004 002	WASHER	HDVIS INSERTS			50	P	(PER PURCH. DEPT)
1005 003	KNOB	MOLD	65	325	650	P	
		DR & TAP JIG	22	110	220	P	
1006 002	SCREW-SPECIAL	FORM TOOL		4	8	I	
1007 002	POST	NO TOOLS					
1008 003	GUSSET — RIGHT	PC. & TRIM DIE	48	240	480	P	
1009 003	" — LEFT	(USE ABOVE TOOL)					
1010 004	CASE	PC. & NOTCH DIE	62	310	620	P	
		PC. DIE	44	220	440	P	
1011 002	BRACKET	MILL FIXTURE	24	120	240	I	
		DR. JIG	32	160	320	I	RECOMMENDED
1012 002	GEAR	DR. JIG	24	120	240	I	I/HRS. I & P
		ARBOR	18	90	180	I	133 5421
			602	3026	6102		

TYPE C-1500 CONTROL

column for totally purchased tools shows no breakdown at all, but the hours should be the same as for internal build although the rates are usually higher. In effect, we are estimating all tools for internal build and using a factor to determine purchased tooling costs.

The small code column, I or P, lets the tool estimator determine where

2. Standard memo form.

TO: E. J. JONES - COST ANALYSIS DEPT. DATE 10-22-59

B/R 5050 TOOLING B/R CHECK SHEET EQUIP. TYPE C-1500 CONTROL

REF: E. J. JONES MEMO 10-15-59

This estimate was prepared from the following material and in the following manner:

1. a. 100 % set of prod'n drawings; b. 0 % set of eng'g drawings; c. 0 sketches
2. Other, (specify) NONE
3. ____ Model, as follows: Indicate type NONE
4. 4. hrs. spent on this estimate. (man-hours)
5. 100 % estimated degree of design stability, (100% - no expected revisions; to be estimated by engineer) Engineer's endorsement G. C. Howard
6. Estimated tooling is (approx.) 0 % Temporary, 20 % Semi-permanent, 80 % Permanent
7. 0 % of tooling is available, 0 % Company owned, 0 % Customer owned
8. Quantity(s) tooling estimate is based on 2500 _____ _____ _____ _____.
9. Quantity(s) prior tooling est. based on NONE PRIOR _____ _____ _____ _____.
10. Tool refurbish ( ) is, (X) is not included on summary sheet. $ 0.
11. Longest tool procurement of (X), or build lead time ( ) in months is 3.
12. Equipment estimated as (X) a unit, ( ) by sub-assemblies, ( ) both.
13. Tooling common to NOTHING will be utilized for this equipment.
14. Value of common tooling utilized is $ 0 and is ( ) is not (X) included in sum'y sheet
15. Portion of refurbishing charges limited to "common tooling" are $ 0 attributable and is ( ) is not (X) included on summary sheet.
16. Ind. Engr. hours 20 Charges $ 100 pro rate according to dollar value of each unit.
17. In our opinion (X) enough, ( ) not enough time was allowed for this estimate.
18. Unless otherwise noted, tool costs for purchased "spec" items and for miscellaneous assembly line tooling are not included. Estimates re to be supplied under separate cover from Purchasing and Assembly Methods Departments.
19. Comments: THIS IS FAIRLY SIMPLE EQUIPMENT WITH NO DIFFICULT FAB. PARTS.

Allan J. Young
Tooling Department

10-22-59
Date

B/R 5050 BUILD QTY. — 2500

ASSEMBLY OR PART	INTERNAL TOOL PROGRAM		PUR. TOOL PROGRAM	RECOMMENDED PROGRAM		CONT.	TOTAL RECOMMENDED PROGRAM		MISCELLANEOUS	
DESCRIPTION	INTERNAL HOURS	INTERNAL COST	PURCH. COST	INTERNAL HOURS	I & P COST	%	INTERNAL HURS	COST	ASS'Y TOOL	PUR. SPEC. ITEMS
C-1500 CONTROL	602	3026	6102	133	5721	10	146	5963		

3. Breakdown of tooling costs.

TOOL COSTS ESTIMATE continued

the tooling should be built at the time of his estimate, and he codes it accordingly. Some tools, of course, should never be purchased, and there are some tools which will always be purchased because they just can't be built internally, usually for lack of facilities. For reference purposes then, the estimator totals all three columns, but these figures are not used for pricing the equipment. The most important cost figures are those shown at the lower right, which gives the total number of internal shop hours necessary to produce our share of the tools, and the total internal and purchased cost of tools, under the estimator's recommended program. These figures are then transferred to the tool cost summary sheet which is presented to the Cost Analysis department. The tool cost estimate sheet, as shown in Fig. 1, never leaves the Tool Engineering department. It is filed there along with the estimate request, copies of the summary sheets, and any other information pertinent to pricing the equipment.

The summary of the tool cost estimate, as presented to the Cost Analysis department, consists of a standard memo form, shown in Fig. 2, which lists under what authority the estimate was made, and all other pertinent information on the particular equipment, and a tool cost breakdown sheet. Items one through five in Fig. 2 indicate from what material the estimate was made: type of drawings, sketches, models, etc. Item eight shows type of tooling estimated, and Item nine lists availablity of tooling. Items on refurbishing indicate amount of rework on any existing tooling which might have been built for other equipment and can now be used for producing some parts of this equipment.

Fig. 3 shows the accompanying form that gives the breakdown of tooling costs, as estimated, and has a space for a contingency column. A tooling program is usually estimated exactly as it is seen by the estimator, but there are always underlying factors of which he is aware, such as possible revisions, parts which he knows will be difficult to fabri-

cate, incomplete bills of material, or an unrealistic delivery date which will influence the cost of tooling. Any or all of these things can enter into determining a contingency factor which will directly increase the cost of tooling. This, then, is plugged into the breakdown of estimated tooling costs and usually explained in the comments section (Item 21) on the summary sheet shown in Fig. 2.

A tool cost estimate, prepared in this way, is an aid to many people and departments within the company, and will always be the basic background file on specific equipment for the Tool Engineering department. The emphasis is and should be on proper preparation and presentation.

• • •

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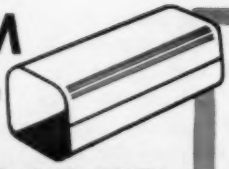

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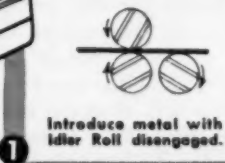
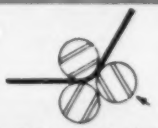
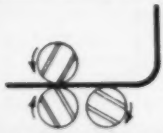


1 Introduce metal with idler Roll disengaged.



2 Roll thru to desired point and engage idler Roll.

3 Continue bend until angle is formed.



4 Disengage idler Roll and roll to next point.

5 Engage idler Roll to make second bend.

6 Repeat process until shape is formed.

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By **Paul Prikos**
Prikos & Becker Tool Co.

THE PRACTICAL DIEMAKER

ESTIMATING FORM DIES FOR "U" AND "Z" BRACKETS

■ Form dies are relatively easy to estimate because they require less skill to build than cutting dies (compound, blank, etc.) where close fitting is necessary. The only element of risk in quoting the hours required to build a form die is the development time. In other words, there is a certain amount of "luck" that rides with the diemaker in blank development which is done in the form die. Some estimators will include some of the development time of the piece part blank in the companion blank die; however, it rightfully belongs in the form die estimate.

General practice is for the diemaker to make three to six hand-made blanks after making his form die in the soft (not hardened form blocks) stage. If, upon the first press development tryout, the blank length is not in tolerance, the diemaker will shape or round off the form punch radii or perhaps put more set into the part to produce a passible blank. It is in this area of tinkering by the diemaker that either builds up or reduces the estimated hours. One clue to the proper blank development is when a diemaker has his bench strewn with an excess of such semi-developed blanks. Either he isn't qualified, the proper supervision is lacking, or the nature of the piece part is unusually difficult with spring back problems and the like.

The estimating of form dies is, in a way, a two-part

estimate: the time devoted to the actual die construction, and the "guesstimate" for development time. Remember though, that form dies are almost always less expensive than blank or cutting dies, so even the "guesstimate" of development time won't be too far out of line in actual hours.

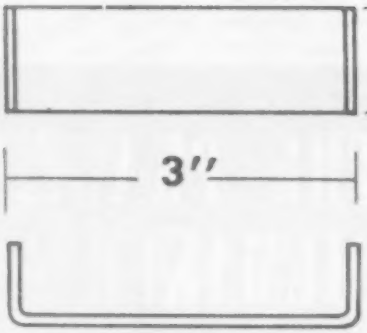
Let's take the case of two different forms as shown in Figures 1 and 2. One is "U" shaped and the other "Z" shaped. Furthermore, let's confine the form die to the spring pad type. There are others like "V" type without a pad, or some with air cushion, and so on. However, a majority of form dies use the spring pad, so this discussion is confined to this type of construction.

Quickly then, the "U" shape die is generalized to be about 40 hours. Here is the breakdown: (Fig. 1-A)

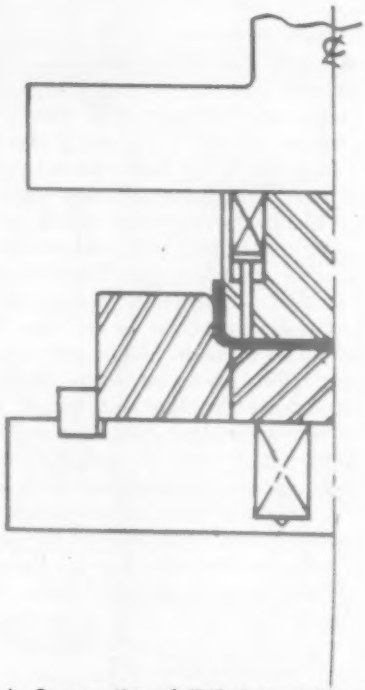
a. Form blocks (2)	10.0	hours
b. Form punch (1)	6.0	"
c. Pressure pad (1)	5.0	"
d. Nests to locate part (2)	4.0	"
e. Ejector pins (2)	2.0	"
f. Keys (2)	2.0	"
g. Development	6.0	"
h. Mounting and tryout	10.0	"
	45.0	hours

Material	$ 40.00	Die set
Build	40.00	Material
45 Hours @ $7.00 =	315.00	
	$395.00	Total

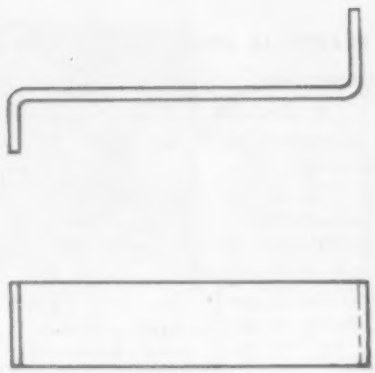
Now for the more difficult double



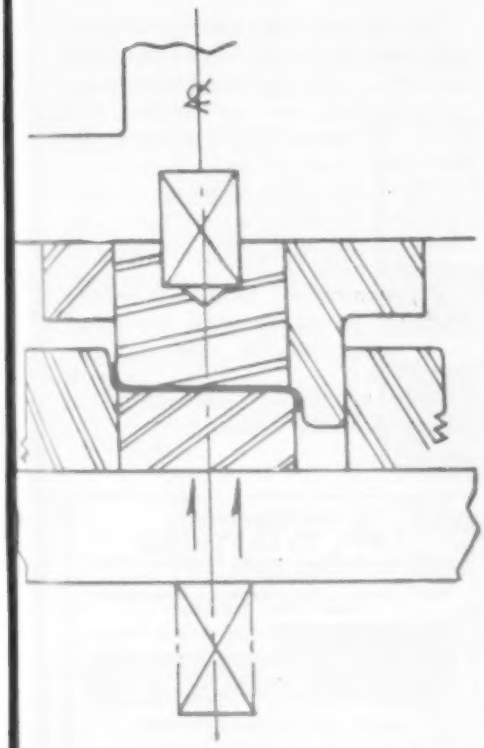
1. "U" bracket.



1-A. Cross section of "U" shape spring pad.



2. "Z" bracket.



2-A. Typical cross section of "Z" form die.

pad "Z" form die. Because of construction it is tricky and it should be avoided. The reason is that the reliability of compression is based solely on springs. The upper spring overpowers the lower one and unfortunately springs have their greatest compression when the die is "home" (closed) when it is least needed. Hence, a degree of timing and tinkering is required to overcome improper stretch of the blank. Also we must avoid locking the blank so it will be able to have the natural plastic flow of metal over the radius point. Generally speaking I play this die safe and allow extra time due for unavoidable troubles. This die should be about 90 hours. Here is the breakdown: (Fig. 2-A)

Same hours as Fig. 1-A, except add for extra work on double spring pad, plus more development time.

Hours	45.0	(from above)
For extra punch and paper pad	20.0	
Timing and troubles	20.0	
	85.0	

Material	$ 40.00	Die set
Build	50.00	Material
85 Hours @ $7.00	595.00	
	$685.00	Total

To analyze a few component parts of form dies here are a few considerations when arriving at the estimate:

(1) To machine a set in the curve radii by grinding a radius in the form block should take about 5.0 hours longer in average dies not larger than 12 x 12 inches.

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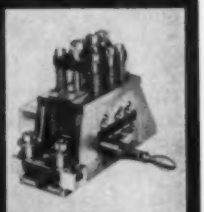

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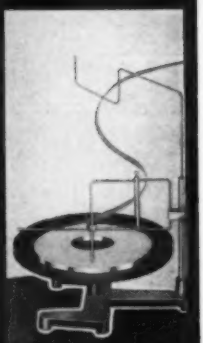

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(2) Positive K.O. with a spider arrangement will take about 6.0 hours average.

(3) A two-step form die is an economical means of eliminating an additional die set. However, if the part is cumbersome, avoid this type of die. Usually the only diemaking savings is in the extra die set.

(4) A four sided form die, the type to make a box, incurs an additional 12 hours for the extra two sides. Again we assume an average form die to be 12 x 12 inches or smaller.

(5) On stainless steel type of piece parts use form die blocks made of H.C.H.C. steel or Graph-Tung to avoid galling and pit marks. Add about 10% more to your estimate for this type of die.

(6) Avoid a combination of cutting and forming in a form die because maintenance costs become abnormally high.

(7) Remember, form dies require little or no maintenance compared to a cutting die like blank or compound dies. • • •

Next month we will discuss a simple draw die estimate.

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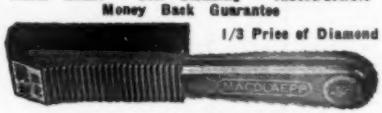

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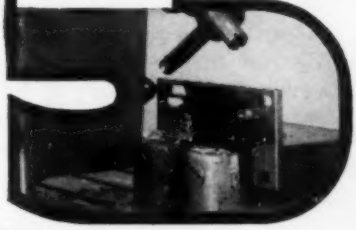

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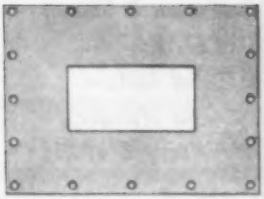

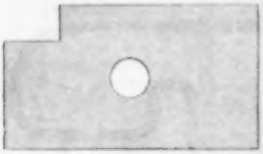

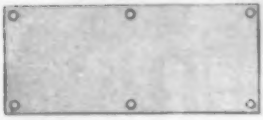

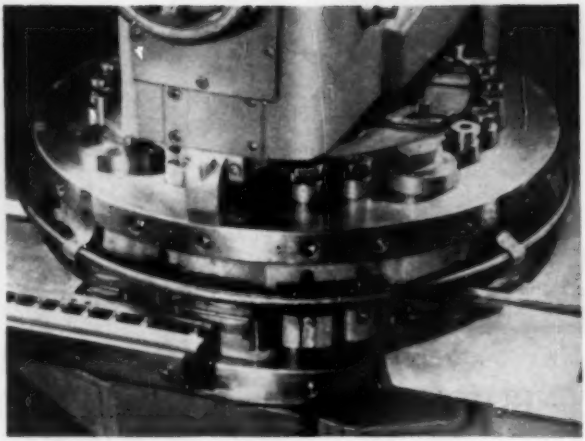

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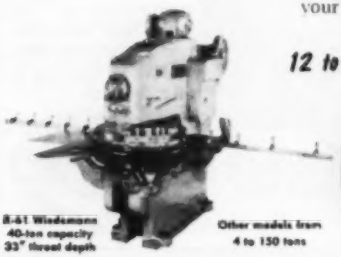

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By **L. P. Sohles**
Morse Twist Drill & Machine Co.

CUTTING TOOLS

HOW MUCH LIP RELIEF FOR DRILLING?

■ When a drill does not cut freely, one cause may be that the cutting edge relief is inadequate. The obvious remedy in this case is to increase the amount of cutting relief on the lips of the drill to secure proper work material penetration.

Just how much relief may be allowed depends on the material and tool edge strength. Excessive relief is not desirable, since cutting lips must satisfactorily withstand the ensuing breakdown in cut for as long a period as possible.

In practice, the amount of relief needed is most often determined by empirical methods. Higher relief angles generally provide best results with light feeds and with the low strength non-ferrous materials. Some of the plastics and cast irons also require higher relief angles because of their abrasive characteristics. With the hard materials and with heavy feeds, reduced relief angles provide cutting edges with additional support to carry the greater loads involved.

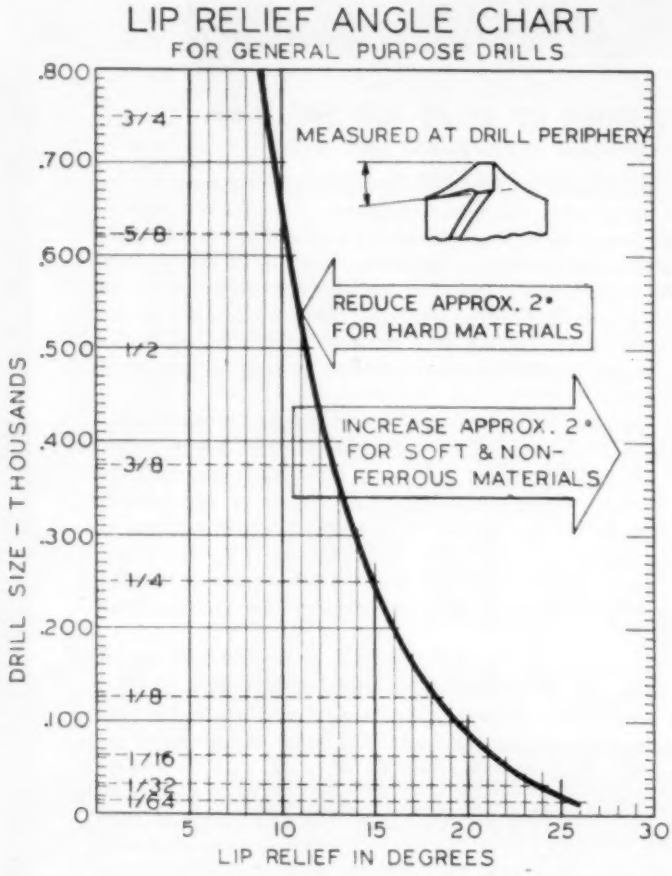
General purpose lip relief angles, as supplied on standard drills, are adaptable to a variety of materials. Having been established through actual use, they form a excellent base in determining the relative values of lip relief required for drilling operations.

The curve shown in the illustration has been plotted to show the pattern of lip relief over drill size range of from 1/64 inch through 3/4 inch. Drills larger than 3/4 inch usually carry about 8° lip relief for general purpose work.

Adjustment of the plotted values to higher or lower relief angles for soft or hard materials, as the case may be, is suggested on the chart. Small drills, due to their lack of torsional stiffness, require high relief angles to permit free-cutting penetration of the material being drilled.

Close application to charted values is not suggested. Variations in material and types of drill points must be taken into consideration, in conjunction with the deviation that may be permitted in actual lip relief angles without appreciably affecting drill performance.

• • •



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LANDIS *Machine* COMPANY
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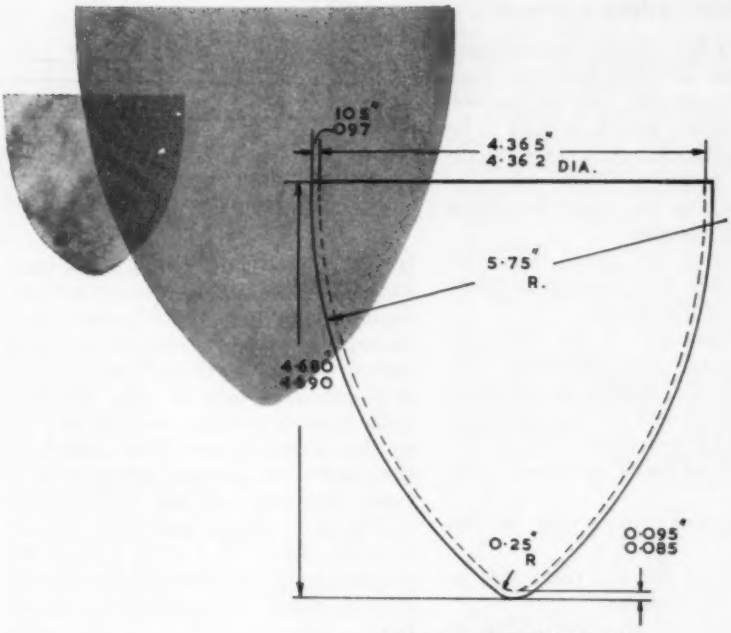


1. Tapered steel shell stamping.

Producing a TAPERED STEEL SHELL

By **W. Walker,** Birmingham, England

■ The pressing illustrated in Fig. 1 needed to be produced in large quantities and very quickly. The material specified by the contractors was a low carbon steel, suitable for cold working and for welding. The notable features of the design included:

1. The close tolerance on the inner diameter of the pressing, for this class of work, 4.365/4.362 inch diameter.
2. The gradual thinning of the walls of the pressing.
3. The shape of the nose.

After several experiments, a modification to the mouth of the shell, calling for machining to a depth of 0.375 inches, and the formation of a slight 45 degree chamfer on the outer wall, as in Fig. 2, was agreed to.

The need for urgency necessitated the purchase of stock material from several sources; this led to the following problems, which needed to be overcome without any serious alterations to the tools:

1. Differences in metal condition and surface texture.
2. Difference in metal thickness, although within the commercial limits and specified tolerances.
3. The reactions of the different grades of metal after heat treatment.

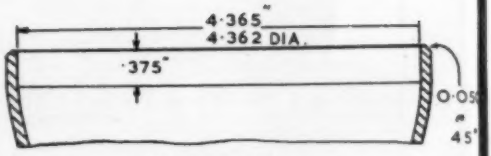
Operating difficulties experienced in the early stages of the contract, some of which persisted when a different supply of metal was used, were as follows:

1. Spring-back properties in the metal.
2. Scoring of the die rings due to insufficient lubrication.
3. Puckering of the shells due to an excess of lubricant on the surface of partly finished pressings.

The material finally chosen was a 0.2% carbon steel, capable of being welded and suitable for deep drawing and similar cold working operations. The steel, as close to this specification as possible, and in sheets, 0.125 inch, was obtained.

Presses of adequate capacity were available, and the operational sequence, to produce this part, was as shown in Table 1.

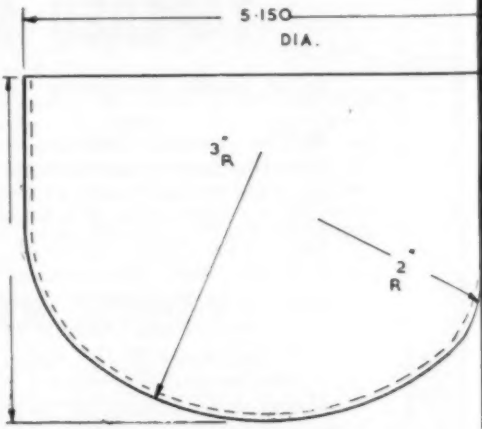
The blanking tool was simple in design. The punch body was made from cast iron with a blanking face of case-hardened steel. The die was built with a body of close grained cast iron, with the cutting edge being made up from a series of high-carbon, high-chromium steel sections. These were fitted in the circular body



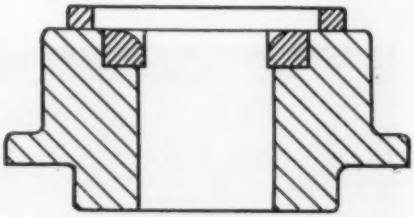
2. Mouth of shell.

by set screws and rough faced and bored. These were then removed, hardened and tempered, and reset in position with the addition of dowel pins in previously drilled holes in the sections. The face of the die was then ground and the bore opened up to the required size. The mouth of the bore was ground to provide a taper clearance of one half degree.

The dimensions and form of the cup are shown in Figure 3, and the cupping tools are illustrated by Figure 4. The body or bolster was made from a close grained cast iron, with a draw ring of Meehanite. This annular Meehanite casting was turned plus 0.010 inches on the outside diam-



3. Dimens.ons and form of the cup.



4. Cupping tools.

eter, plus 0.016 inches in thickness, and minus 0.012 inches in the bore.

After machining to these dimensions it was heat treated slowly and uniformly to 560° Cent. (1040° Fahr.), and further heated rapidly to 870° Cent. (1600° Fahr.), at which temperature it was soaked for 90 minutes. The ring was then quenched in oil, and tempered to 200° Cent. (390° Fahr.) followed by a further quench in oil.

The punch was made from a 2% carbon, 12% chromium air hardening steel, which was heat treated to provide maximum compressive strength. After heat treatment, the punch was ground with a soft, open structured wheel and polished to provide a superfine surface.

To effect the gradual thinning of the part from the center, it was found necessary to provide a slight taper on the underface of the blank holder, to permit a varied resistance. By experimenting with this taper and that of the blank holding pressure it was possible to obtain the necessary gradual thickening from the center of the cup. The cups were checked for thickness of the nose, using a dial indicating gage, every five minutes by a patrol inspector.

The tools for operations 4 and 5, Figures 5 and 6, were similar in design to the cupping tools, except that a blank holder was not necessary. The hardened steel punches pressed the component through the die, altering the dimensions and changing the shape. During these two operations, the fol'owing dimensions

TABLE 1—OPERATIONAL SEQUENCE

No.	Operation	Machine
1	Cut to strip	Power guillotine
2	Blank	80 Ton Power Press
3	Cup	100 Ton Power Press
4	1st draw	100 Ton Power Press
5	2nd draw	100 Ton Power Press
6	Trim to length	Capstan lathe
7	Degrease	Trichlorethylene bath
8	Anneal	Electric furnace
9	1st form	100 Ton Power Press
10	2nd form	100 Ton Power Press
11	Size O.D.	80 Ton Power Press
12	Trim to final length, bore and chamfer	Capstan lathe
13	Degrease	Trichlorethylene bath
14	Lanoline dip	Bath

were kept under close control:

(a) The thickness at the nose.
(b) The wall thickness.
(c) The depth of the pressing.

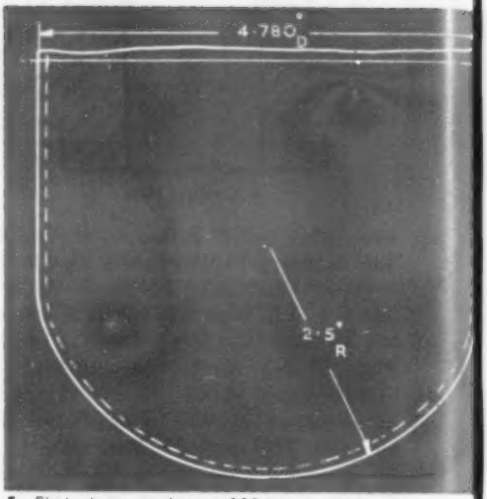
Because of material variations it was found necessary, in some instances, to include a further redrawing operation in the sequence; a slight ironing effect was introduced to insure a pressing of the correct length.

For this operation, an extra draw ring was used on one of the existing bolsters, and a punch of a cheaper oil hardening steel, hardened and polished, was made.

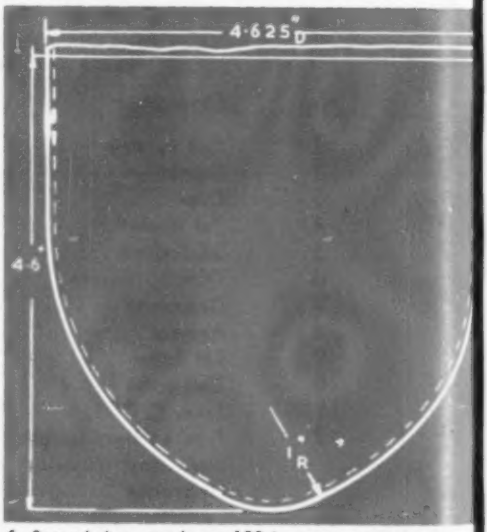
The pressings were trimmed to a predetermined length using an adapter of cast iron and an air cylinder on a small capstan lathe, as illustrated in Figure 7. After trimming, the pressings were loaded on to prong racks and degreased in a trichlorethylene tank before being passed to the heat treatment department.

The heat treating operation consisted of loading the pressings on racks of heat resisting steel into a furnace. The heat was raised reasonably quick to 650/670°Cent. (1200/1240°Fahr.); the parts were soaked at this temperature for 30 minutes. The furnace was allowed to cool slowly when the pressings were withdrawn and given an air blast to remove a very fine coating of dusty scale, which had formed on the surface. One batch of steel gave good results when heated to 600°Cent. (1110°Fahr.) for a period of 60 minutes.

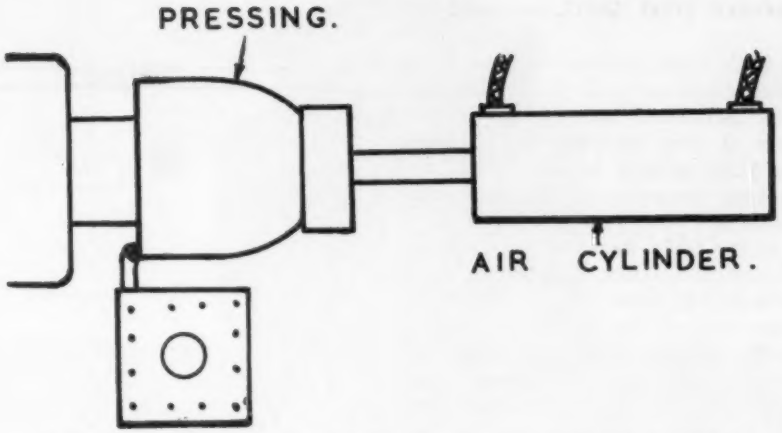
An unorthodox procedure was used for the two forming operations, and the tools for the first of these operations is shown in Figure 8. The press-



5. First draw made on 100-ton power press.



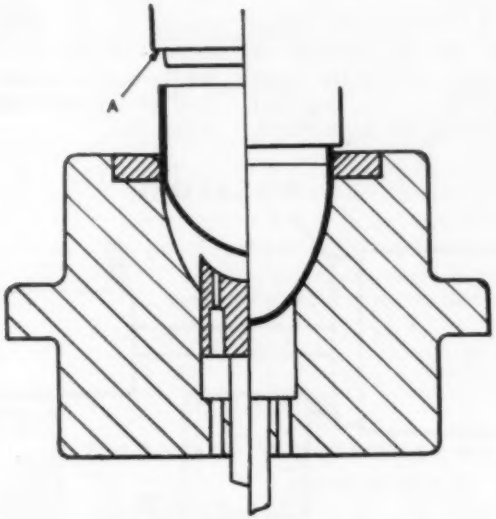
6. Second draw made on 100-ton power press.



7. Stamping is trimmed on a turret lathe, using cast iron adapter and air cylinder.

ing is seated in the die, and the two-diameter punch descends. The square cut face of the punch, A, contacts the trimmed edge of the pressing and forces down into the die, shaping the shell to the contour of the die; hence the need for a fully annealed condition of the material. Figure 9 shows pressing.

The punch and the ejector piece



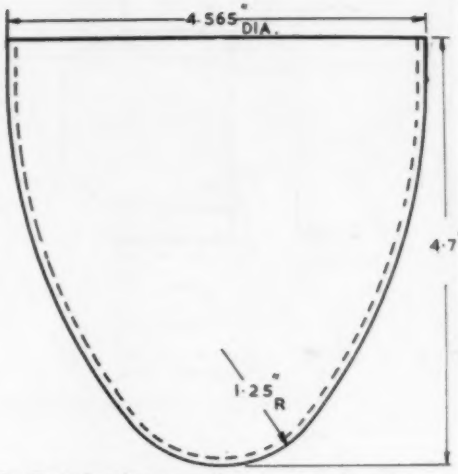
8. Tools for the first forming operation.

of both tools were made from hardened high-carbon, high-chromium steel mentioned before. The bolsters were of close grained cast iron and the draw rings of Meehanite. All the working faces were ground and polished.

In the early stages of the contract, lubrication troubles were experienced at both of these stages; too little lubrication of the wrong sort caused scoring of the draw ring, while an excessive use caused puckering of the shell. The solution to these problems was to wipe the outer face of the shell with a graphite impregnated oil.

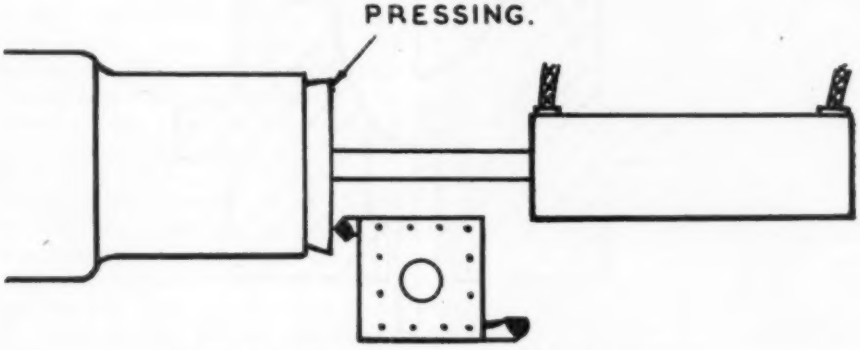
The final sizing, or ironing, operation called for tools of a similar pattern. The final machining was performed on a capstan lathe, using equipment similar to that used for operation 6, as shown in Figure 10. The two remaining operations need no special comment.

From being a worrying job at the commencement, the production of these shells became one of the most trouble-free contracts in the shop and lessons learned during the early stages were later embodied in the design of other tools.



9. First forming operation on power press.

It must be remembered, however, that strict control was exercised by the Inspection Department at all stages of the press-working operations. This, no doubt, was responsible for the speedy completion of the contract to the satisfaction of all parties concerned. • • •

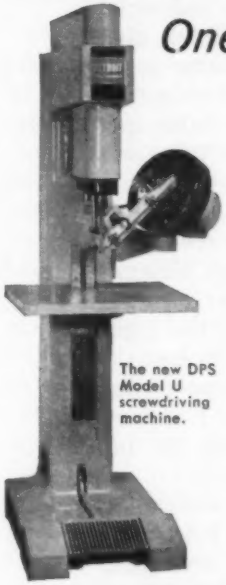


10. Final sizing operation is performed on turret lathe.

How many ➡

what's your guess?

Screws are #8—32 x ½ inch long.



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Practical Arbitration, Time Study and Work Simplification—Part XII

Converting a "Slowdown" into a Lively Production Center

By **Harold R. Nissley,** Consulting Engineer

■ Some of the regular readers of these industrial engineering articles may, at this point, think that all of the answers to cost and productivity problems are to be found on the slide rules of industrial engineers or consultants. To prove that these specialists do not have all the answers, the following experience is related.

Recently a works manager invited me to discuss some incentive and plant layout problems with him. I seemed to have passed my "preliminary" examination in good shape, because shortly after meeting the works manager he turned me over to the company president. The president asked me if I could convert a slow-down into a lively production center quicker and more cheaply than did his own company personnel a few months previously. Here, in his own words, is the president's story:

'A mail order house gave us a large order for a power tool. To get this order we had to trim our price down below our original cost estimates. Then after we got the order we really had to go to work on our costs. We even set up a special department for the production of this tool so that we could control its manufacture especially during its final costly assembly stage.

The Personnel Manager plays the "villain" in this little drama entitled: "How We Doubled Our Production without the Help of Industrial Engineers or Consultants"

"Most of our people are on piece work; they average about 40 per cent above their base pay (compared with a contract provision of 30 per cent). We did not wish to put this new job on piece work, initially, due to the many variables involved. However, we knew we would have difficulty in luring experienced people away from other jobs, if we paid them only their base pay. So we agreed to pay anyone moving onto this new job his previous average hourly earnings until such time as piece work standards were placed on the job. Incidentally, this was against the advice of our company industrial engineers. Under these conditions we had no trouble in filling the 21 new jobs.

"But, just as our industrial engineers forecast, we got little or no work out of these 21 old timers—despite the fact that we put one of our best supervisors in charge of this new activity. I believe this supervisor could have handled this slow-down himself, if he had not spent so much time outside of his department with design and tool engineers and meetings connected with this new product .

"Not even the grapevine had started to work in this new department; every time I or any other management man passed through the department most of the gravy-train riders were doing nothing. I had my own ideas about how to handle a situation like this. But I thought there is no use paying a Personnel Director $12,000 a year, if we were not going to use all of his talents. After the warning my industrial engineers gave me I knew it was useless to approach them for a solution to this slow-down problem.

"So here is what the Personnel

Director came up with: He suggested that we give each man, caught stalling, a discharge warning notice. If this did not straighten things out, the supervisor would send a second offender to the Personnel Director who would fire him in accordance with the previous warning notice. The Personnel Director pointed out that the Union would then move in and demand that the man be reinstated *with back pay*. The Company would then 'reluctantly' reinstate the man; and after a stiff token 'fight' the Company would pay the man the few days of back pay he lost while he was 'discharged.' The Personnel Director stressed the idea that the discharged employee would have to come back 'through channels' —*i.e.*, he must apply for re-admission through his supervisor who in turn would recommend that he be given one more chance. My Personnel Director offered to play the part of the 'bad guy' in this play by putting up a 'stiff fight' against reinstatement.

"I suggested," the President continued, "that one condition of reinstatement be that the discharged employee bring a note or a letter indicating his willingness to do a better job than he had done in the past. My Personnel Director ruled against this for two reasons: (1) Most people don't like to write; and (2) most people are reluctant to apologize or admit they have been wrong. He felt that such a written expression might be rubbing it in and might make the returned employee the target for some group jokes. So I did not press for my written note idea although I still think it is a good idea.

"Well, I am both curious and a bit of a gambler. So I turned the whole matter over to the Personnel Director. He went out onto the production floor with the supervisor, who called the 21 employees together and told them of the discharge warning notice plan just formulated. The supervisor asked for any questions; there were none.

"The following day, three warning notices were given to three men caught stalling. There were no comments from anyone.

"The third day, one of these three men was caught stalling again—a man with nine years of service. The supervisor sent him to the Personnel Director who, after a short talk with the man to verify the facts, 'fired' him.

"As we expected, the Union moved in and demanded the man be reinstated *with back pay*. But the Personnel Director, according to plan, refused to budge. However, he said he had no objection to their taking their case either to the supervisor or to the president.

"Next they came to me. I told them this was out of my department. Finally they went to the supervisor who, according to plan, 'reluctantly' wrote out a recommendation that the discharged employee be reinstated—and, if possible, with back pay (two days). The Personnel Director accepted the recommendation. He thus regained part of his lost prestige and the matter was settled.

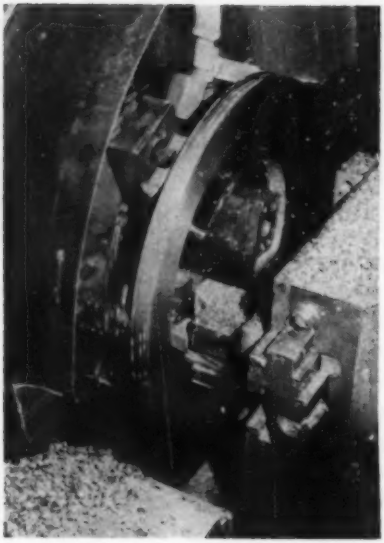
"Thus we put the control of the new department right where it belongs—in the hands of the supervisor (not with the industrial engineers; nor in the Personnel Department; nor in the President's Office). And we accomplished what we started out to accomplish. The week after his 'discharge,' production in this department doubled. Since then we have had small but steady weekly increases in production.

"Counting my time and the back pay of the discharged employee, this whole thing probably cost us less than $100. Now, Mr. Nissley, could a consulting engineer or any industrial engineer double the output of a 21-man department in a week's time for $100? You don't have to answer this question, if you don't want to."

Control of the new department was placed where it belonged—in the hands of the supervisor.

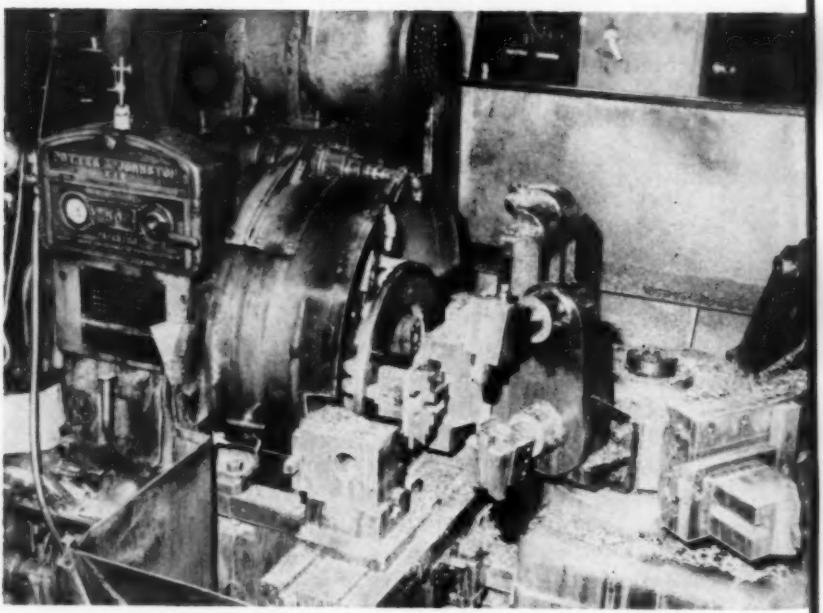
The writer's only reply to the president was this: "You are grossly underpaying your Personnel Director." • • •

This article ends another very pleasant relationship with the Hitchcock Publishing Company and more especially with the staff of the MACHINE & TOOL BLUE BOOK. I want to thank the readers who have written to me (and to the BLUE BOOK) about these articles. I hope I get to meet you all, personally, one of these days. By the time you read this I will be winding up a series of seminars in Japan for 30 Japanese consultants—a 7-week project.—*Harold R. Nissley*



After a year of trial

Ceramic tool finish faces a torque converter plate at the fourth station of turret lathe. Material is cast iron, 40 R_c. Depth of cut: .028-in.; speed: 1050 sfpm; feed: .007 i.p.r. Surface finish attained is under 100 RMS and eliminates a former grinding operation. Chamfers are required for entry and exit of tool to avoid shock chipping of the ceramic.



and error, they enjoy . . .

SUCCESS WITH CERAMICS

Twin Disc Clutch Co. engineers are happy with results achieved in surface finish, tool life and elimination of grinding

By **Darrell Ward,** Engineering Editor

■ Tests with ceramic tools back in 1957 at Twin Disc Clutch Co., Hydraulic Division, Rockford, Ill., paralleled results experienced by many other companies. Twin Disc was interested in acquiring a good enough surface finish on several facing operations to eliminate grinding.

The early tests, according to Grant E. Cedarleaf, Works Manager, were nearly all failures. Some of the ceramic tools would chip or break the moment they entered the work.

"This was such a problem in the beginning," Mr. Cedarleaf said, "We weren't even able to avoid chipping in ceramic inserts on the machines with hand feed controls. If we were able to enter the work to start a cut, the tip would snap the instant it ran into a shoulder. The initial shock of the heavier load fractured the insert."

The first success at Twin Disc was with a new ceramic insert for facing a cast iron converter housing. No carbide tool would hold the required 125 RMS finish for the 40 R_c material. Not only did the ceramic tools produce a better finish than was required and eliminate a former grinding operation, they ran for over two months and still looked as good as new, Mr. Cedarleaf said.

One operation we observed at Twin Disc was a 40

"Under ideal conditions . . . (ceramic) tool life would

R_c cast iron plate for a torque converter. It was being machined on a 13-year old Potter & Johnson Model 5D automatic turret lathe, with automatic indexing on four stations of the tool turret. The part was chucked on the I.D. with three jaws.

The O.D. and I.D. were rough turned on the first station. Operations on the second station included rough facing, chamfering the I.D. and O.D., as well as a 20 deg. bevel. The O.D. and I.D. were finish turned at the third station. All these stations were tooled with carbide inserts. A ceramic insert was used on the fourth station to finish the face.

In this finish cut on the face, 0.028" material was removed at a rate which attained 1050 sfpm at the O.D. Feed rate across the 3½" face was set at the minimum for the machine: 0.007" per revolution. The ceramic insert was a TBT-123P4 VR-97 triangle shape held in a KTGR-12 Kennametal ¾" tool holder.

With this setup, the surface finish was consistently held below 100 RMS as required; grinding, normally required after carbide cutting, was eliminated.

The machine operator said that if he could feed slower and increase the speed to compensate, he could do the same job in the same or less time—but, with a much better finish.

It was learned that the ceramic tool could not be retracted across the

Rough casting at left and finished parts at right demonstrate results from finish facing operations with ceramic tooling.

appear to be almost infinite."

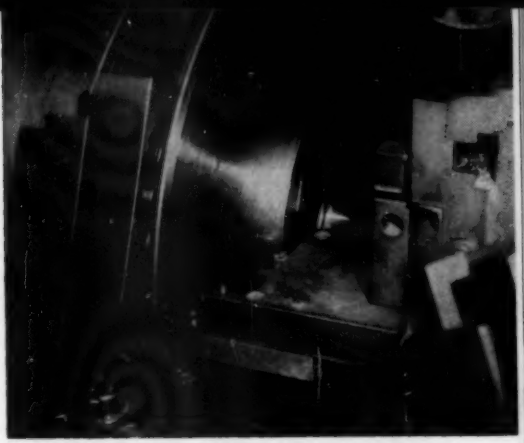
work because it would chip every time. The production setup was to withdraw the tool turret to avoid any possible contact after the cut.

It was also discovered that the depth of cut should not be less than 0.015" to 0.025" with the ceramic cutter for a satisfactory surface finish. The operator has experimented with cuts as deep as 0.034" to 0.035" and produced a good finish.

The ceramic tool cannot enter directly into a rough casting cut. It must be led into the work with a previously machined chamfer (45° was found best) to avoid shock contact. The rough natural finish of the casting had an irregular leading edge which caused the tool to chatter. On the part in question, the blueprint called for such a chamfer. On parts without chamfer specified, the shop would put a chamfer on both I.D. and O.D. corners of the face. Both entry and exit of the tool require gradual lead in and lead out to prevent chipping the ceramic.

Mr. Cedarleaf's opinion of ceramics, after two years of testing and a year of successful production, is that ceramics definitely have a place in industry, especially where there is a good solid workpiece, rigid machines, and a good surface finish is required without grinding.

"So far," he said, "we have not been successful in using ceramics on interrupted cuts. The tool must be in contact at all times. The brittleness of the ceramic causes chipping every time we attempt anything but continuous even cutting."



Facing an impeller wheel part from an OD of 19.2-in. to an ID of 12.766-in. SFPM ranges from 1,780 to 1,185. Depth of cut is .013-in and feed is .004-in. Material is AISI C-1144. Twenty seven parts have been run holding below 125 RMS finish before VR-97 ceramic insert had to be indexed.

The problem with ceramics, compared with carbide, is a matter of about twenty years of development, according to Mr. Cedarleaf. At one time carbide tools were too brittle and would chip under the same conditions that now cause the ceramics to chip, he reminded the writer.

Could ceramics soon catch up on the 20-year lag merely because of the Industry's experience with carbide under parallel situations? Mr. Cedarleaf does not believe this will happen. "Ceramics," he said, "could not necessarily be improved in the same way as carbide. Perhaps, an entirely new or different method of formulating ceramics might change all this. But, so far, the properties of ceramics are too different from carbide to follow very similar methods of development. At the same time, the basic problems with ceramic tooling might be overcome if ceramics manufacturers could come up with some kind of mix that would do the job as

well as present tools, yet still take a shock load.

"A major difference between ceramic and carbide tools is that ceramics must keep a much sharper edge. This one factor may become a big issue in the differences between materials which seem otherwise parallel."

The shock of a ceramic tool entering the work is the big problem. But, once the cut starts, there is no problem if sufficient speed and depth of cut are maintained.

For the same reasons, a tool cannot be permitted to dwell. It must cut constantly, or a chatter will begin and immediately chip the ceramic.

These factors greatly influence the selection of equipment to be used for ceramic tooling. Inherent machine limitations, especially in those with fully automatic cycling, may rule out practical use of ceramics in certain machines.

On the other hand, if hand control is available to begin infeed, before automatic cycling begins, the shock problem can be eliminated. The alternate is to use a tool with lead-in geometry.

The first ceramics tested at Twin Disc were far more brittle than recent inserts. "On the same jobs we are doing now," Mr. Cedarleaf said, "we couldn't even use the first ceramics. Manufacturers have overcome the original extreme brittleness, and we are getting their tools into operations not considered possible two years ago."

General conditions for successful work at Twin Disc were spelled out in a straightforward manner. Basically, the machine, the work, the tool, the tool holder, the drive and feed mechanisms must all be much better than what may be appropriate for carbide tooling. Both work and tool must be from 35 to 50 percent more rigid to avoid chipping under similar operations. No tool chatter whatever can be permitted with ceramics.

Yet, as Mr. Cedarleaf pointed out, under ideal conditions of minimum stock removal, rigid holding of the workpiece, rigid tools, and positive drive, tool life would appear to be almost infinite. And, finish is 30 to 50 percent better with ceramics than with carbide.

No special chucks are really necessary, but there can be no play in the machine bearings or sloppiness in gibs and ways. Careful chucking of the part is required for rigidity and the chuck jaws must be balanced perfectly.

He passed along a tip for inexperienced operators who are not familiar with ceramics: never use a ceramic tool in setting up a job; use a carbide insert for the setup. Then, switch to the ceramic for actual cutting. When the ceramic is pressed against a workpiece without cutting, it chips. If there is a question of variations between the replaced carbide and the ceramic insert, a dial indicator should be used on the tool block for positioning the ceramic as a last step in the setup.

Twin Disc uses only standard patterns of throw-away inserts, developed by ceramic manufacturers. They are quite happy with the results they have obtained in surface finish, speed of operation, long tool life, and elimination of grinding. Patience and persistence did the trick. • • •

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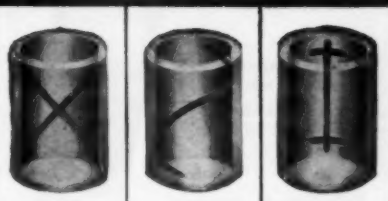

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To "trim the fat" from your tooling budget, consider...

MULTI-PURPOSE TOOLING

By **Clement F. Brown**
Production and Methods Engineer

■ The tool engineer is frequently confronted with the problem of designing tools that can be used for similar parts and/or different operations. More than likely, low production jobbing operations offer the greater possibilities for the multi-purpose approach. However, even large production runs can sometimes be seriously considered in this respect.

Your initial step is to evaluate the possibilities for functional, multi-purpose tools. To assist in making your decision, the following check list offers some points for consideration:-

(1) *Are special tools (jigs, fixtures, dies, gauges, etc.) required for production operations on a series of two or more similar parts?*

Standard tools are usually the most economical to do a job. When they are not available, special tools must be designed or developed for the operation. An affirmative answer leads to the next question.

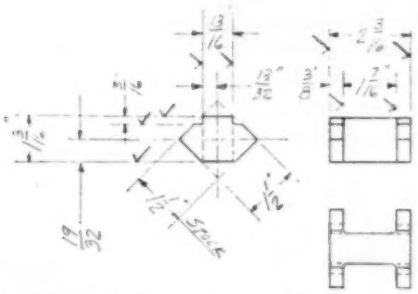
(2) *Are two or more parts similar enough to be handled with reasonable ease in a single tool for a specific operation? Can the tool be used for more than one operation on a part or parts?*

Radically dissimilar parts seldom bear further consideration for multi-purpose tooling. The same is true of an overly elaborate tool to handle more than one operation. Two simple units are practically always

more economical than a complex one.

(3) *Will multi-purpose tooling be compatable with production requirements (with regard to time schedules and quantities)?*

If all operations must run continuously to meet schedules, multi-purpose tools cannot be considered. On the other hand, when part time operations will adequately handle your requirements this course may well be pursued.



1. Welding boss (Part No. X-1001) for No. 2 bearing housing.

Sequence of Operations

1. Cut 1½" sq. bar to 11¾" long on abrasive saw. (Each piece makes five)

2. Load stock in fixture and mill one side of bar to 19/32" dimension. Use milling fixture No. 1

3. Reverse stock in fixture, mill to 1-3/16" dim. and straddle mill to 13/16" x 3/16" dim. (Simultaneously using 3 cutters.

4. Cut (5 pcs.) from each bar to 2-3/16" long. Position to stop.

5. Load 6 pcs. at a time in fixture No. 2. Mill 1-7/16" wide, cut 13/32" deep. Reverse (6 pcs) in fixture, repeat milling on opposite side to 13/16" dim.

6. Deburr all edges of parts in tumbling machine.

(4) *Is limited storage or operation space a problem?*

This point is usually of little consequence for tools of average size. However, it may become of major importance in the case of large assembly fixtures that take up valuable floor space. In such a case complex tooling may pay dividends in spite of inherent disadvantages.

(5) *Will the time expended in tooling changeovers for different parts offset actual (or estimated) tooling savings?*

This is an important "dollars and cents" point to consider. Maximum advantage is always gained in any operation when the parts can be completed in one machine set-up. This cannot always be done. The cost of several tooling changeovers may quickly void any gains made in tooling economy. To illustrate this point, let's solve a simple problem:-

For a certain machining operation on two similar parts, two fixtures could be built for an estimated cost of $200.00 each. A single dual-purpose fixture would cost $350.00. Production schedules call for 5 lots to be produced of each part; it would take the machine operator .5 hours to make the necessary fixture changes for each lot. A cost of $8.00 per hour will cover the man's labor and overhead. Is the dual-purpose fixture warranted?

2 single fixtures @ $200 ea. . . $400.00
1 dual-purpose fixture. $350.00

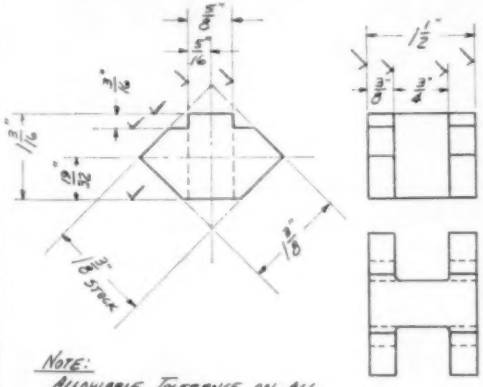
5 lots @ 2 parts each results in 10 operations or 9 tooling changeovers. 9 changes @ .5 hrs. ea. X $8.00/hr. equals $36.00.
Total for 1 dual-purpose fixture is $386.00.

The result shows an advantage ($14.00) in favor of the dual-purpose fixture. If each part could be produced at its initial machine and tool set-up, a $46.00 advantage would result.

$400.00 – ($350.00 + .5 Hr. X $8.00/hr.) = $46.00

The approximate break-even point would be met at 12 tooling changeovers. Beyond this point, the economic advantage definitely favors the use of two fixtures.

With these points in mind, let's take a look at a couple of examples of multi-purpose tooling developed for two similar parts where milling is the major operation.



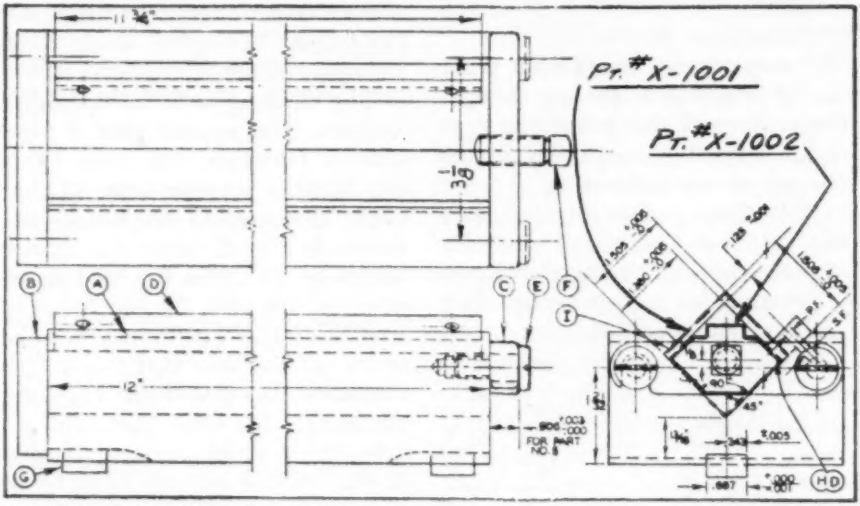
2. Welding boss (Part No. X-1002) for No. 2 bearing housing.

For our case study, a pair of welding bosses used in a fabricated bearing housing for jet engines has been selected. Both bosses are machined from square bar stock, the material being AMS 5616 forged stainless steel. A rough machined surface (500 RMS) is satisfactory since critical surfaces are remachined after the weldment is heat-treated. Three hundred bosses of each size are required. One boss (Part No. X1001) is made from 1½" square stock; this part is shown in Fig. 1 along with an operation analysis. The second part is very similar. However, this boss (Part No. X1002) is made from 1⅜" bar stock; dimensional differences are shown in Fig. 2. Note the shorter length of 1½". For the first operation on this part, the bar is cut to lengths of 11½" (sufficient to make seven parts). Note that this length compares closely with the 11¾" long bar cut for the other part. This allows the second piece to readily fit the milling fixture. Loading of a single length of bar (as in Oper. No. 2) reduces handling time and improves machining conditions. All other operations are quite similar to those listed on the process operation sheet.

So much for the production parts. Now let's take a look at milling fixture No. 1 used for operations Nos. 2 and 3. See Fig. 3.

The fixture body (A) is made from a heavy steel bar 2¼" x 4". A recess 1.505" wide is milled down the length of this piece at an angle

of 45 degress with the base. At one end an end plate (B) is screwed to serve as a stop. A swing latch (C) is mounted at the loading end of the body. The latch is fastened in place by two shoulder screws (E). To clamp the bar stock against the end plate, a square head set screw (F) is mounted in a tapped hole in the swing latch. A bar (D) screwed and doweled in position along the open side of the milled recess serves as a retainer for the part stock. Completing the basic fixture, a pair of hardened fixture keys (G) are



3. Milling fixture No. 1 (for operations 2 and 3)

BILL OF MATERIAL

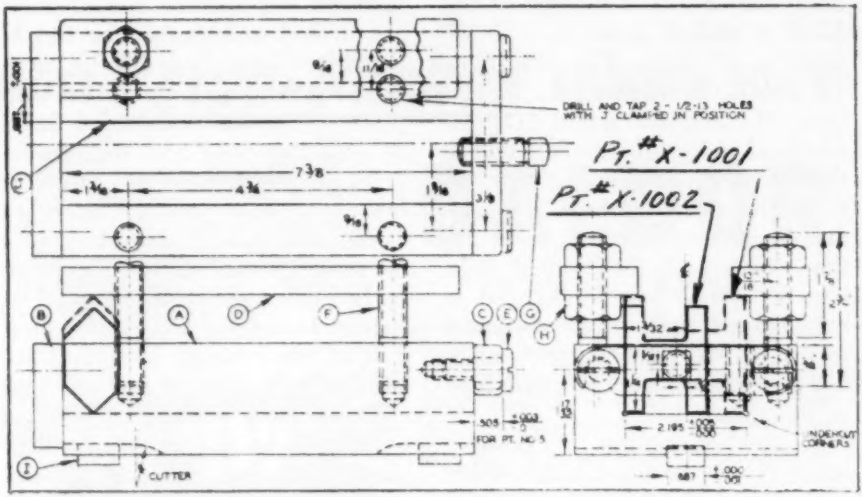
PART DES.	NO. REQ'D.		MATERIAL
A	1	Body—2-¼" x 4" x 12-⅛"	C.R.S.
B	1	End Plate—½" x 2" x 4⅛"	C.R.S.
C	1	Swing Latch—½" x ⅞" x 4-⅛"	C.R.S.
D	1	Bar—⅜" x ½" x 11-⅞"	C.R.S.
E	2	Shoulder Screw—¾" Dia. x 1-⅜	C.R.S.
F	1	Sq. Head Set Screw—½"-13 x 1-¼" Lg.	St'd.
G	2	Key—⅜" x ¾" x 1-⅛"	Key Stock
H	1	Bar—⅜" x ⅝" x 11-⅞"	C.R.S.
I	1	Spacer—.125" x ⅜" x 12"	Gage Stock

Note: Minor fixture parts (screws, dowels, etc.) are not included in the Bill of Material.

screwed in the milled keyways in the body of the fixture.

The fixture as described is ready for use in milling the 1½" square bar. To mill the smaller 1⅜" stock, a couple of simple changes are made. The retainer bar (D) is removed and replaced with another bar. The second bar (H) is ⅛" wider to accommodate the smaller sized stock. At the opposite side, another spacer (I) is inserted. This spacer is ⅛" thick and held in place by (3) flat head machine screws (not shown).

For either part, the fixture setup is not changed between operations Nos. 2 and 3. However, operation No. 2 is done with a plain milling cutter while a gang mill-



4. Milling fixture No. 2 (for operation 5)

BILL OF MATERIAL

PART DES.	NO. REQ'D.	STOCK SIZE	MATERIAL
A	1	Body—2" x 4" x 7-½"	C.R.S.
B	1	End Plate—½" x 2" x 4-⅛"	C.R.S.
C	1	Swing Latch—½" x ⅞" x 4-⅛"	C.R.S.
D	2	Bar Clamp—½" x 1-⅜" x 7-¼"	C.R.S.
E	2	Shoulder Screw—¾" Dia. x 1-⅜"	C.R.S.
F	4	Stud—½"-13 x 2-⅞" Lg.	C.R.S.
G	1	Sq. Head Set Screw—½"-13 x 1-¼" Lg.	St'd.
H	8	Hex. Nut—½"-13	St'd.
I	2	Key—⅜" x ¾" x 1-⅛"	Key Stock
J	1	Spacer Bar—¾" x 1-¼" x 7-½"	C.R.S.

Note: Minor fixture parts (screws, dowels, etc.) are not included in the Bill of Material.

ing set-up (using a plain cutter flanked by a pair of side milling cutters) is used when machining the other side of the bar stock (operation No. 3).

Milling fixture No. 2—developed for the fifth operation on both parts—is shown in Fig. 4. A 2" x 4" steel bar is used for the fixture body (A). Down the length of this block is milled a recess — 2.195" wide x 1¼" deep. The end plate (B), shoulder screws (E), fixture keys (I) and set screw (G) are identical in design and function to their counterparts on the first fixture. The swing latch (C) is similar to its counterpart except for the location of the tapped hole. The set screw (G) — located in this tapped hole — is positioned to furnish the best average clamping pressure on the two parts held in the fixture.

A pair of clamps or retainer bars (D) are mounted at the milled recess—one on either side. Mounted on four studs (F), they are fastened in position with hex nuts (H). The clamps are set at sufficient height to allow the parts to be loaded in the fixture with a sliding fit across the corners of the bar stock. These retainer bars keep the parts from rising out of the fixture due to the action of the milling cutter. It is occasionally necessary to adjust the height of the clamps due to slight irregularities in the stock size of the bar.

Converting this fixture for the corresponding operation on the 1½" long boss is a simple matter. A spacer bar (J) .687" wide is placed in the 2.195" wide body recess. The spacer is held in position by two socket head screws (not shown) located in the side of the block. With the spacer securely fastened, two additional ½"-13 holes are drilled and tapped so the ½" diameter clamp studs can be properly repositioned. Note that this produces partially threaded holes in both the body and the spacer.

To accommodate the smaller bosses, it is a simple matter to insert spacer (J), relocating and lowering clamps (D) to the proper height to grip the stock. The fixture holds six pieces of either part at one loading. The parts are slid into the fixture on end and clamped back to back. Milling is done with a side milling cutter of the required width. Note the phantom outline of both parts in the end view of Fig. 4.

Summary of Savings

Fixture No. 1 was made useable for the smaller size bosses by simply adding two additional spacers (H and I) and three tapped holes and flat head machine screws for mounting spacer (I). To adapt fixture No. 2 for the smaller part, the spacer bar (J) and two socket head screws were the only additional parts required. In either case,

changeover time as related to production requirements posed no problem.

As a final thought on economy, note that several minor pieces on each fixture—the end plate, shoulder screws, base keys and the square head set screw—are identical. If production schedules do not require both fixtures being used at the same time, these parts could be interchanged between the two fixtures. This may appear to be stretching economy to an unreasonable limit. The point is granted. However, the thought may merit attention on one of your uses of multi-purpose tooling. • • •

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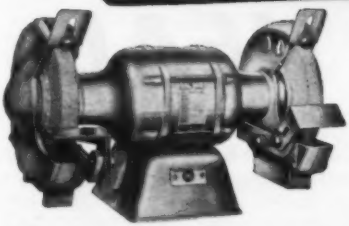

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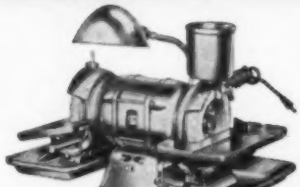

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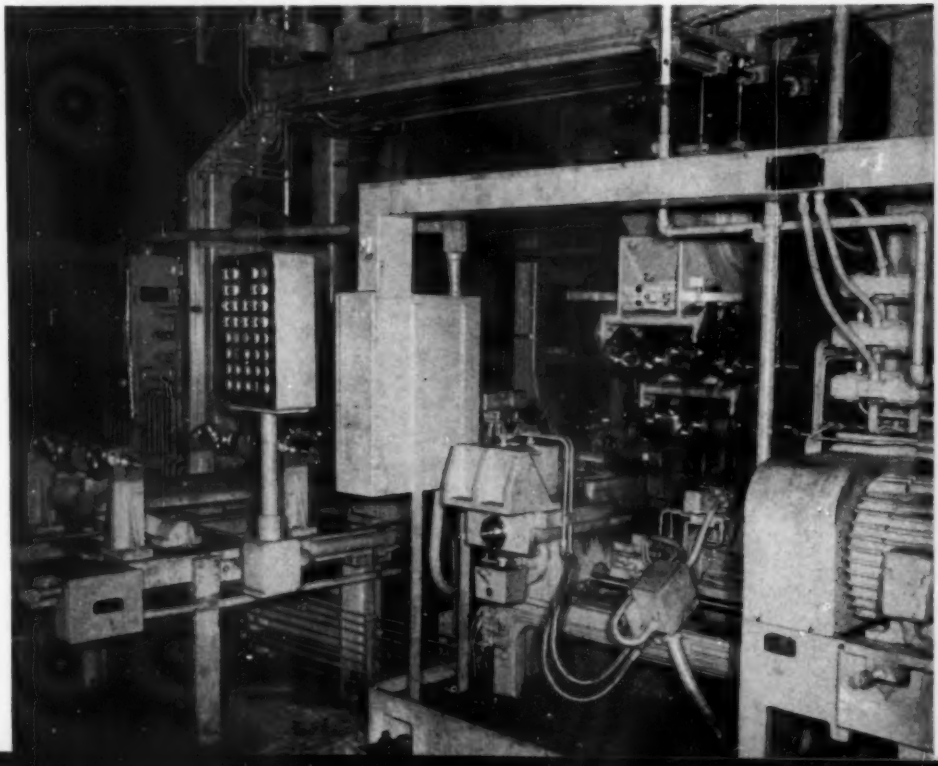
LIMA ENGINE PLANT LINES REBUILT FOR NEW FALCON

■ The efficient production techniques and extensive use of in-process quality control gages that have insured quality machining of V-8 engine blocks and component parts at Ford Motor Company's Lima, Ohio, engine plant, are employed in the production of the new 6-cylinder Falcon engines.

Sundstrand lathe turns thrust walls and oil seal flange and faces the nub oil slinger of crankshaft.

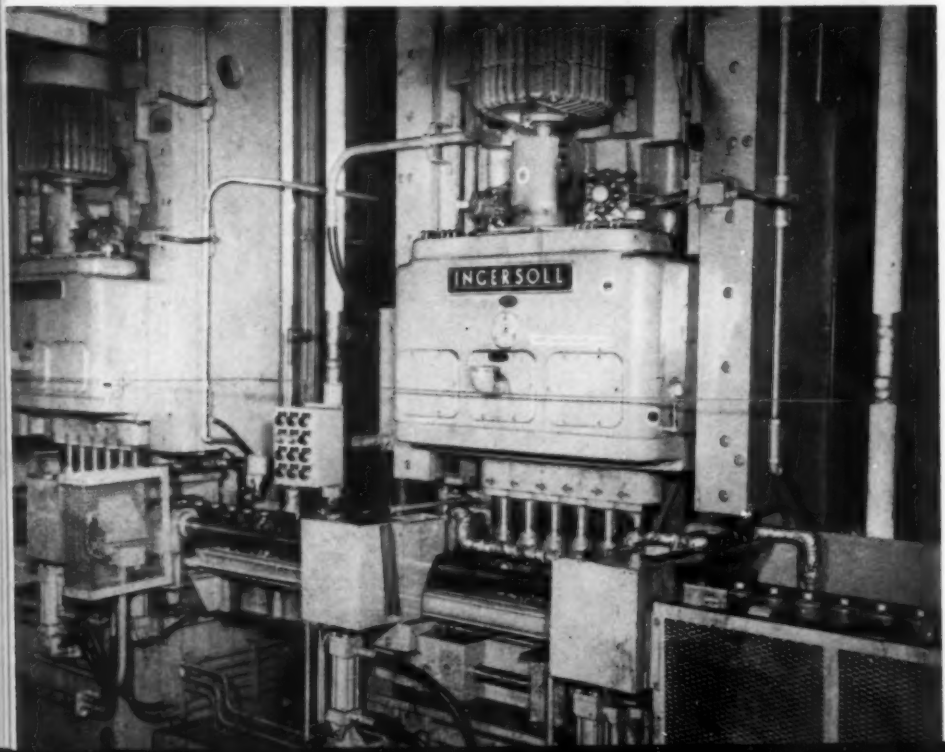


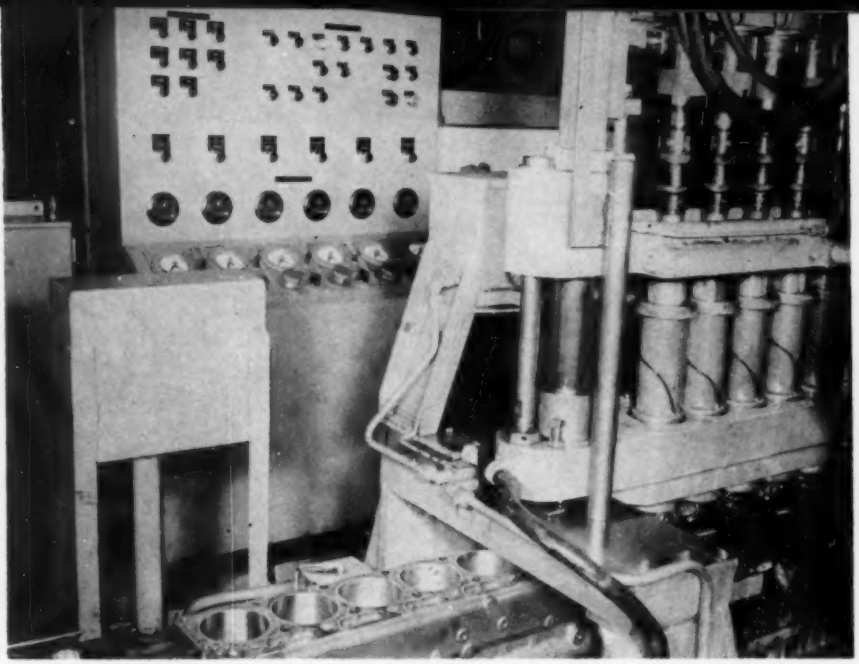
Ford's decision that every part that would go into the Falcon would be specifically designed for it, posed the problem of changing one of the 8-cylinder lines to produce the 6-cylinder Falcon engine. Original planning of the Lima facilities to produce the 8-cylinder engines for Mercury, Lincoln, Edsel and Continental, allowed for the high volume production that was anticipated for the Sixties. Ample space, plus the building block concept of machine tool design, can be credited with accomplishing the quick change over to 6-cylinder production in approximately a year's time.

To integrate Falcon engine production into a plant that will continue to produce 8-cylinder engines, involved careful planning in plant rearrangement and appraisal of the existing equipment. It turned out that approximately half of the machines were reworked to produce Falcon engines; all the machines on an existing cylinder head line were rebuilt.

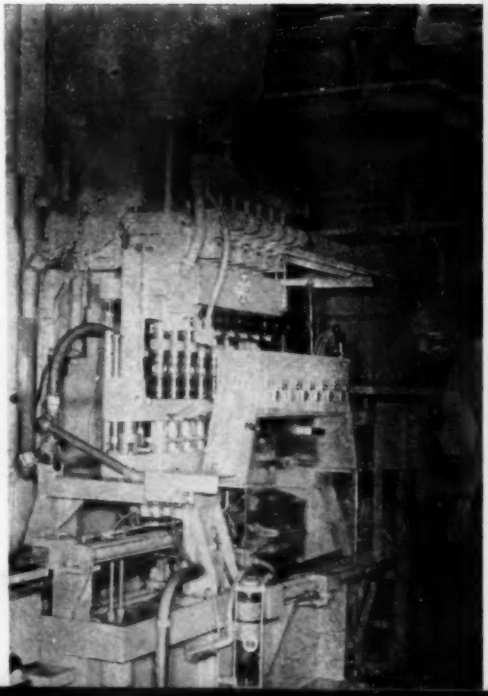
The automatic crankshaft area was hailed as the most completely automatic crankshaft machining line in the automotive industry when the plant was opened in 1957. The Falcon crankshaft line incorporates the same quality control gaging that has worked

This two-station 6-spindle Ingersoll boring machine finish bores the cylinder walls. Chamfering and honing follow.

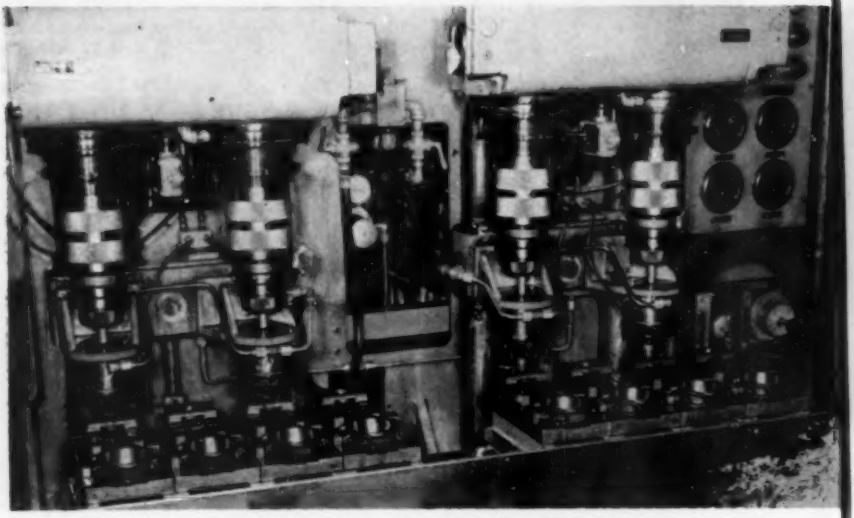




Honing of cylinder walls of block is performed on a Micromatic multi-spindle machine—90 blocks per hour. Above is close-up of reverse side of machine. The front operating end is guarded. In process air gaging allows for an 8-second spark out at the end of the honing process, automatically collapses and withdraws from the block upon final sizing and spark out of all cylinders.

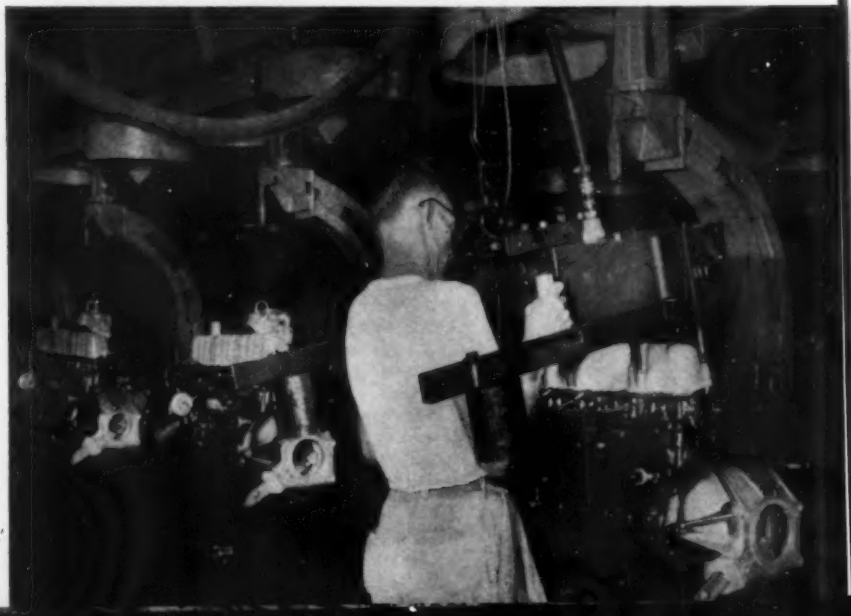


Right: Operating end of Micromatic multi-spindle honing machine honing cylinders of the Falcon engine block. Cylinder walls are finished to between 20 and 30 rms and are held within .0005" for out-of-round. Operator uses Sheffield air gage to make "at random" checks of diameters in four places within each bore and profilometer for checking the surface finish.



Crank and pin bores of connecting rods are honed on four Micromatic 4-spindle honing machines. Above is a view of the 8-position fixture set-up for honing the crank bores. Four positions provide for loading and unloading while honing is performed at the other four positions. Each machine hones 450 parts per hour. Finish obtained is 35 to 59 rms.

View of assembly area where bolts are screwed on the valve covers. Following this operation comes the air test for leaks in the whole engine assembly.



out so well for the 8-cylinder engine lines. After each basic operation the part is inspected, and if the close tolerances aren't met, the gage rejects it and production halts. The control console indicates where the trouble area is, and the tooling must be corrected before machining operations can be resumed.

There is an extensive use of proximity switches to activate transfer equipment. The part passes over the switch and when a close tolerance is reached the switch activates the equipment. All automation equipment in the plant is hydraulically and electrically powered.

The six Landis grinding machines that grind the connecting rod journals are equipped with Citco automatic diamond radius dressers. The purpose here is to maintain a smooth fillet and reduce the possibility of scuffing the bearings.

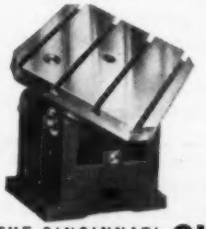
Ford's accent on simplicity of design is carried out in the simplicity of their cylinder block line. Single in-line machines permit more production equipment to be used in the same area and reduce handling and floor space requirements. Chips fall into drags beneath the machinery and are carried into a central system.

The camshaft line is set up similar to the line for the V-8's. One innovation is the induction hardening operation. The castings are placed in a hopper and are automatically positioned on centers on the Tocco. In a 17-second cycle the lobe contours are hardened to 50 R_C to a ¼ in. depth. The Landis automatic camshaft contour grinders are equipped with Citco single point diamonds, which index after every pass.

The Falcon engine has 120 fewer parts than the standard 6-cylinder engine. The intake manifold is cast as an integral part of the cylinder head.

To facilitate the assembly of engine components, the TelAutograph system is used. Just before assembly, the final inspector marks the blocks according to sizes in eight grades. This information is transmitted by TelAutograph to the storage area where pistons have been graded in the same sizes. Matching pistons and connecting rods for the particular block are tagged and placed on a conveyor to meet the block at the assembly area. The Lima Engine plant will be the sole source for the Falcon engine. It is anticipated that ultimately the production of this engine will equal 85 per cent of over-all plant output.

• • •



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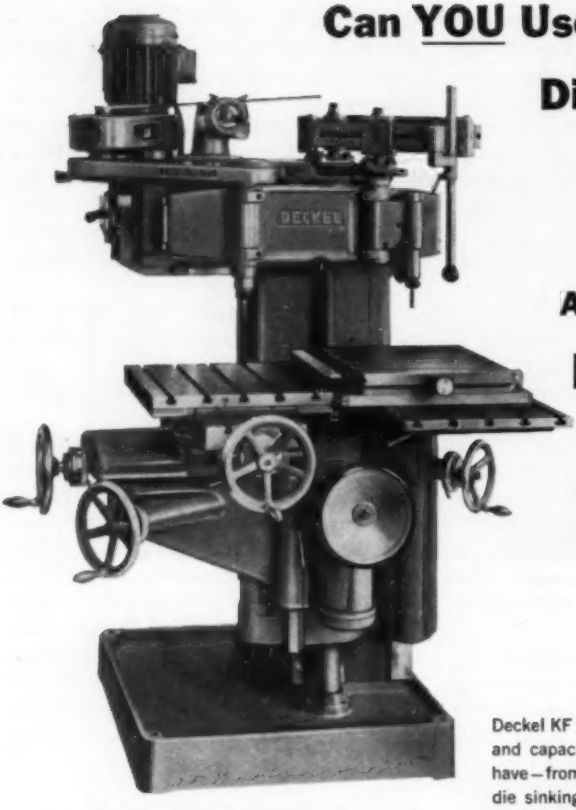

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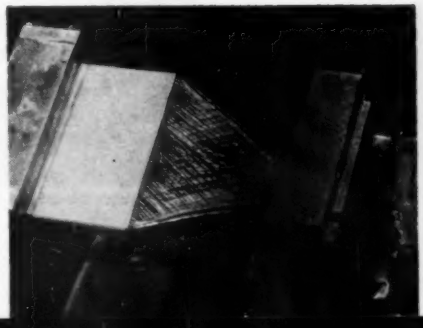
field reports

12

The new Anocut electrolytic cavity-sinking machine, the HCS-59.

ELECTROLYTIC CAVITY SINKING FOR HIGH STRENGTH METALS

Chicago—The new Anocut cavity sinking machine, demonstrated by Anocut Engineering Co. here recently, applies the electrolytic principle to the sinking of irregular holes and shapes following the contour of an electrode made for the purpose. The non-rotating electrode is simply



Knife-type electrode shown approaching a test specimen of Nimonic 80, with electrolyte issuing from the working edge of the electrode. The "knife" may be formed or bent to any desired shape. The electrode shown in the photograph cuts a slot 3" in length and .075" in width. Penetration rate is about .150" per minute.

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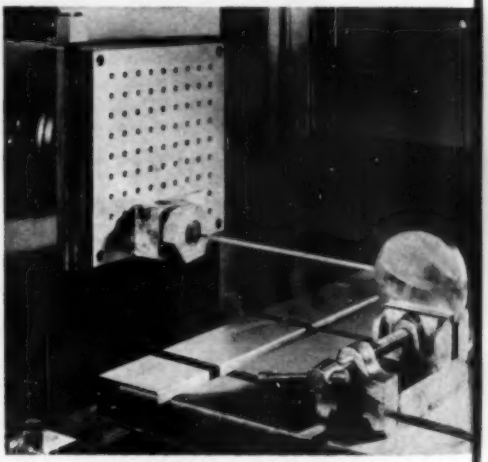
plunged linearly without rotation into the work material.

Since there are no sparks in Anocut electrolytic cavity sinking, there is no wear or erosion of the electrodes or tools. It is possible to produce hundreds of cavities with no electrode wear.

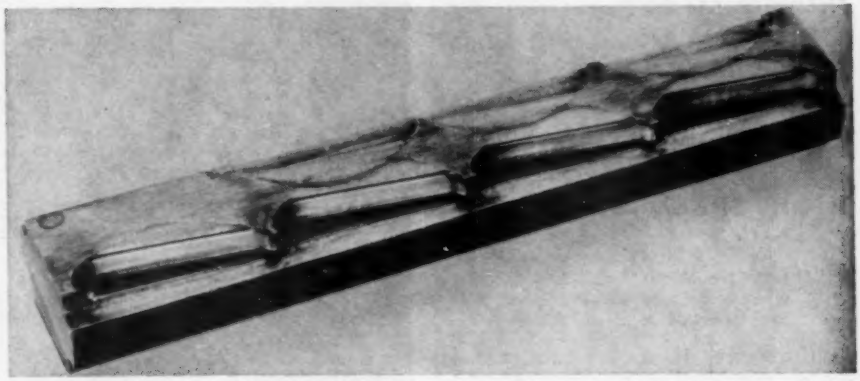
Total volumetric removal is dependent upon the capacity of Anocut power supply unit which is used, and ranges from a removal rate of .030 cubic inches per minute with Anocut's Model 300 (ampere) Supply Unit to a removal rate of .300 cubic inches per minute with Model 3000 (ampere) Power Supply Unit.

It is also possible to mount multiple electrodes so that several pieces may be machined simultaneously. No decrease in penetration rate is caused so long as the capacity of the power supply unit is not exceeded.

During the development period of this new process, particular attention



A test piece of high-temperature alloy is shown here being mounted in a vise with a drill-type electrode mounted on the face plate of the drive ram. The face plate has numerous threaded holes to permit easy positioning of any electrode.



Test bar of Udimet 500 showing seven identical pockets of size and shape required for jet-engine turbine buckets. Time for making each pocket was approximately 30 seconds.

has been given to straight-wall cavities, both through-hole and blind-holes, on high speed steels, high tensile alloy steels, and super alloys of the kinds used in jet engines—Stellite 31, Rene 41, Udimet 500, Incoloy, Stellite 25, Udimet 700, etc. The process is not applicable to non-metallic materials.

Finish varies with the work material. On most materials, it is easy to obtain a finish better than 30 to 40 microinches and on many materials, particularly the super alloy materials, the finish will be better than 20 microinches. The optimum finish is obtained at maximum removal rates, so that ordinarily only one operation is performed to make a finished piece.

Accuracy and reproducibility depend upon the kind of work involved. Under optimum conditions, accuracy better than .0005" has been obtained. Normally expected accuracy is .001" to .002". In some work configurations, errors as great as .006" have been measured. The smallest size holes and slots recommended for production applications should be not smaller than .050" in diameter or slot width. Internal radius dimensions cannot be guaranteed less than .010".

The drivehead consists of two heavy castings, the lower containing linear ball bearings for the ram and also the screw drive for the ram, with the upper casting containing the necessary drive mechanism. The upper casting is fitted with a diagonally mounted cover casting which may be removed to give complete access to all the working components.

The ram is driven through a mechanical speed-reducing device which is manually adjustable. Electric clutches are used to change from normal driving operation to high speed motion for rapid traverse and retraction.

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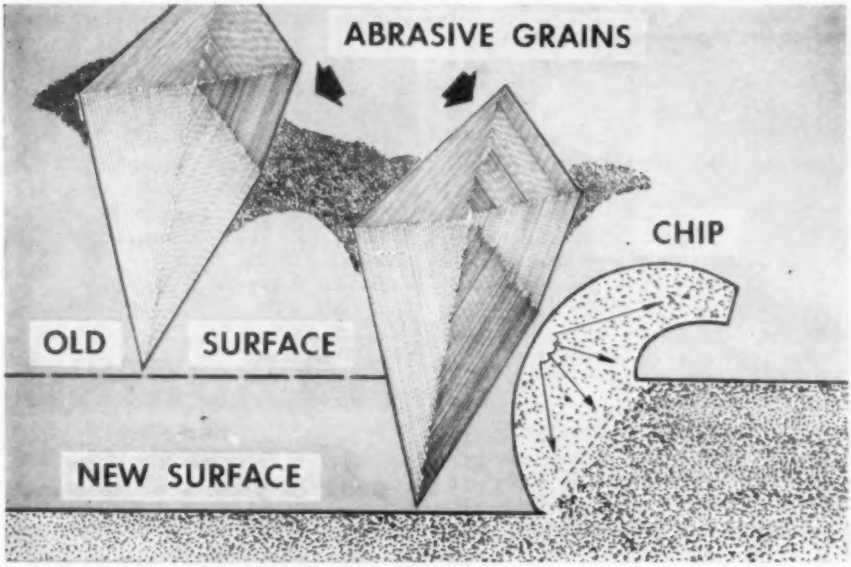
BURN-FREE, BURR-FREE DRY GRINDING OF HIGH SPEED STEELS

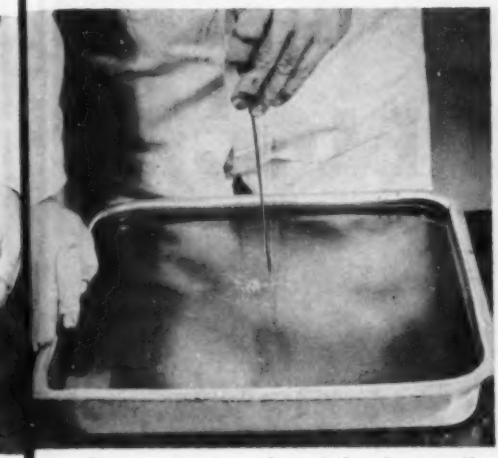
New treatment for grinding wheels retards loading and functions as a dry coolant

■ Currently, in a grinding wheel, all of the intense frictional heat is localized right on the grinding surface. The chips melt and molten metal fills the pores; the wheel is loaded —its grinding surface glazed. A new treatment for grinding wheels retards loading and functions as a dry coolant. Once the wheel has been impregnated by dipping in this abrasive wheel improver—"Dri-Kool," manufactured by King Graphite Products, Inc.—its pore surfaces throughout be-

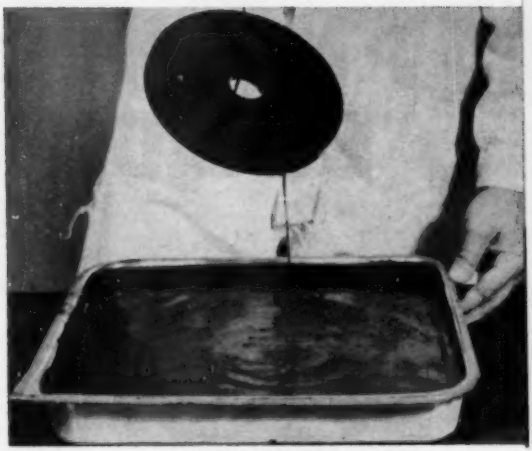
Grinding wheel is dipped into Dri-kool.



Solid lubricant prohibits the chip metal from gripping abrasive and bond surfaces with the usual affinity.



Bubbles rise to surface during impregnation cycle when air is displaced by the coolant.



Wheel is removed and excess material allowed to drip off. Overnight drying cycle follows.

come coated with a parting medium. This solid lubricant prohibits the chip metal from gripping the abrasive and bond surfaces with the usual affinity.

A Detroit broach manufacturer has conducted a research program to determine the effect of the abrasive wheel improver as an assist to grinding high speed steel broach tools. This company reports: "We have experienced a complete loss of burn or excessive heating on the dry grinding of M-3 type of H.S.S." They further report: "Results have been excellent in improving wheel life by a minimum of 30 per cent. The wheel seems to cut considerably faster with a clean, heat-free action."

A manufacturer of high speed end mills and special cutting tools has used the wheel improver for three months. He reports "less frequent dressings; wheels last longer although grinding is faster. On dry grinding high speed steel M-2 and M-3, our finish is burn free; the micro finish grind has been improved along with the elimination of burrs on the cutting edges of our tools."

The illustrations show the treatment process. The wheel is dipped into the "Dri-kool" and becomes impregnated with the material. Removed from the pan the excess material is allowed to drip off the wheel. The wheel is dried overnight. It is the volatile carrier which evaporates, leaving all of the pore surfaces and the interconnecting passageways coated with Dri-kool. This means that all the pore surfaces have been coated with a thermal conductor, which disperses heat throughout the wheel, transmitting it to all surfaces from which it is emitted by radiation.

This treatment for grinding wheels does not affect the dynamic balance of the wheel, nor will it wash out of the wheel when used in conjunction with water or oil coolants. A single treatment is sufficient for the life of the grinding wheel.

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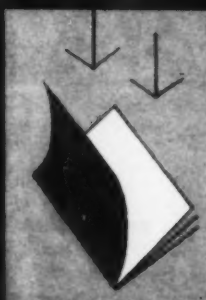

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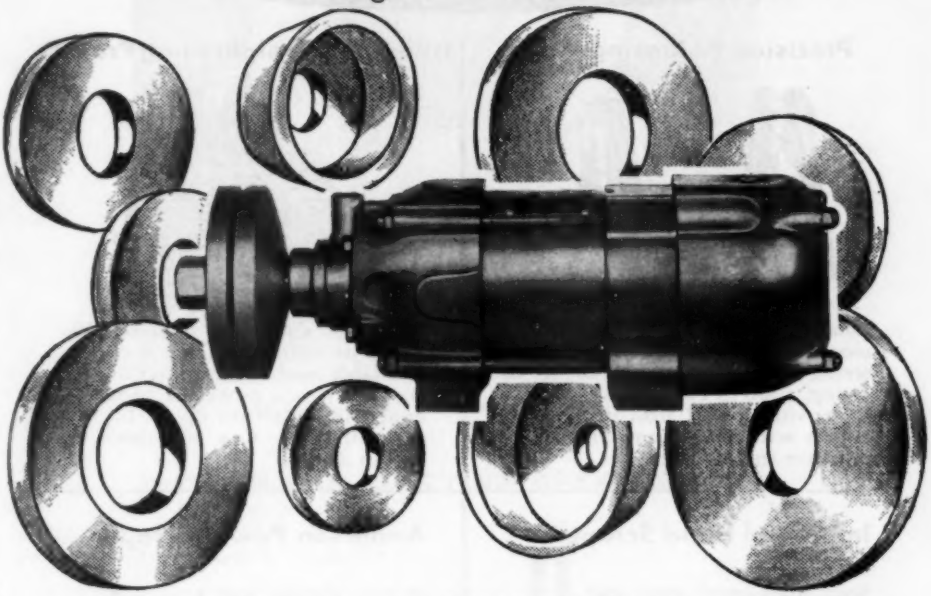

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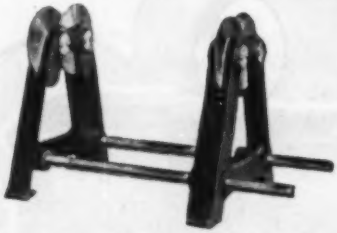

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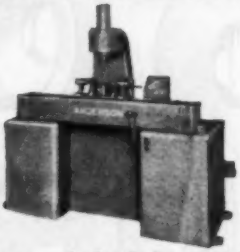

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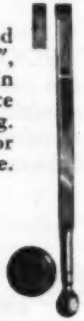

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shop hints and kinks

13

1. Using simple gage, operator marks off length of slot.

HOT TIP FOR SLOTTING OPERATIONS

By **Clement F. Brown,** M. E.

■ The oxy-acetylene flame is one of the hottest and brightest flames known to man. Oxy-propane flames run a close second. When used in combination with automatic or manual flame-cutting equipment, cutting, beveling and slotting operations can often be performed (within certain finish limitations) quickly and at less cost than possible with the machine tools found in the average shop.

To illustrate this point, a large steel, filter pipe offers an excellent case study for an unusual slotting operation. The pipe is 16″ O.D., extra strong (½″ wall thickness) and 15′-8″ long. The pipe's wall contains 704 slots; each slot is nominally ⅛″ wide by 6″ long. Sixteen slots—cut radial to the pipe's centerline—are spaced 22½ degrees apart on circumferential rows. These rows

are on an 8" longitudinal pitch, leaving a bridge 2" long between slot ends. Intermediate rows of slots are equally spaced both circumferentially and longitudinally between the initial rows.

Prior to actual cutting operations, a layout was made with 32 equally spaced lines running lengthwise down the pipe. Starting points for the first 16 slots were marked on alternate lines. Similar points—at the 8" pitch—were indicated for the balance of the slots on these same 16 lines. The intermediate slots were marked in the same manner on the other 16 rows. All starting points were then center-punched. Using a small electric hand drill, a ⅛" diameter hole was drilled at each starting point.

First, a word of explanation regarding the drilling operation. Some preliminary experimental work quickly indicated its value. A drilled hole enables the operator to start a burning cut without "blowing" through the pipe wall. Burning cuts are normally started by spot preheating the metal to its kindling or ignition temperature (about 1600° F for steel) and then releasing a jet of high pressure oxygen—piercing the metal. At the same instant the cutting torch begins its movement in the desired direction. It is relatively easy to preheat and start a clean cut at the plate's edge. However to pierce or "blow" through solid metal at some point beyond the edge is disadvantageous. First, a longer preheat time is required (approximately twice as long—due to the mass of surrounding metal) than for the edge cut. Secondly, the longer preheat time results in an enlarged starting point—as compared with the normal kerf or width of cut. (Kerf is the path of oxidized metal removed by the cutting flame.) Therefore, drilled holes result in clean cut starts—as good as the cut itself—and substantially reduce preheat time. Reduced preheat time helps in the control of distortion, a point that will be discussed a bit later.

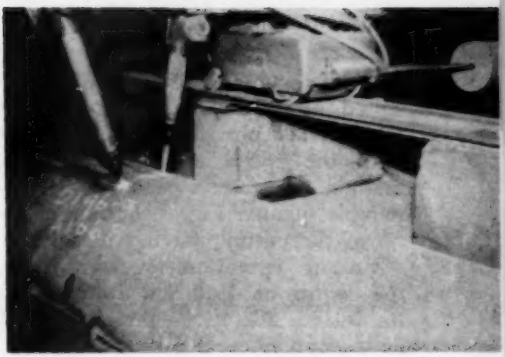
2. Pipe and radiograph set-up for slotting.

With one end of each slot located by a drilled hole, we're ready to start actual slotting operations. The set-up used for this operation is shown in Fig. 2. A small radiagraph was the basic equipment used for cutting. Two cutting torches were properly spaced and mounted on a rack. The included angle between the torches was 22½ degrees. The radiagraph traveled on track sections firmly supported on wood blocks; the blocks were placed at approximate floor level. The pipe—lined up parallel to the track—was supported at each end by a pair of idler rollers. With the torches positioned directly over a pair of drilled holes at one end of the pipe, we're

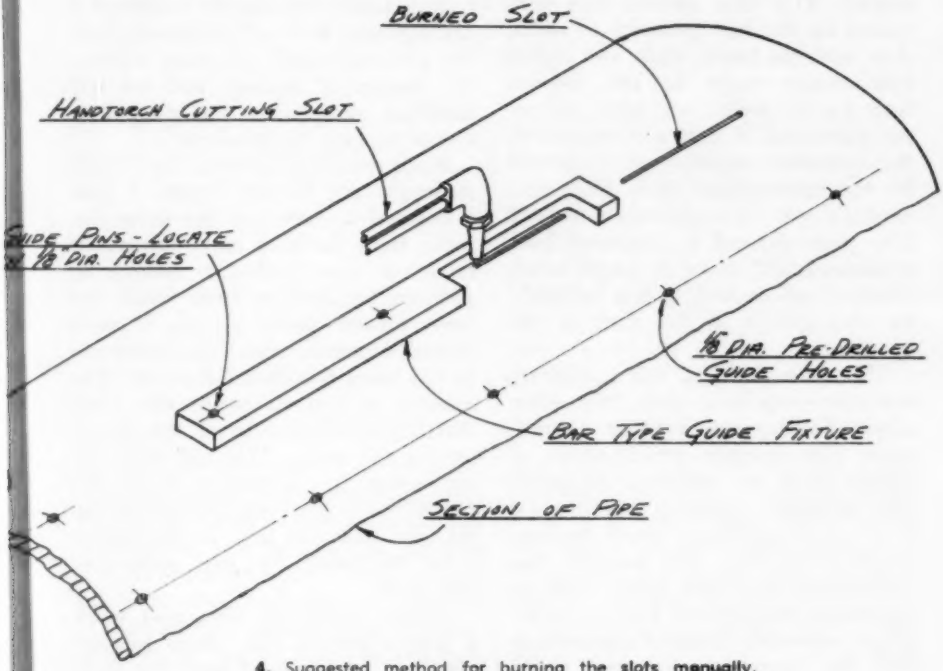
ready to start burning slots.

Before making a series of cuts down the pipe's length, the extent of the individual cuts are marked off with a simple gage—as shown in Fig. 1. The gage was made from a bent piece of ⅛" x 1" flat bar with a short 1/8" diameter pin located 5-15/16" from the marking end. Since two slots were cut simultaneously by the torches, the markoff was done on one line of cuts only. It was also possible for the operator to mark-off the next cut while one pair of cuts was in progress—losing no time from the actual burning.

Torch cutting tips of the proper size were selected to give a slot width (kerf) of ⅛". Radiagraph travel was 15 inches per minute—a good average speed for ½" thick steel. Allowing 6 seconds preheat time for start-



3. Flame cutting torches in action. Note the counterweight on radiograph to balance the weight of the torches.



4. Suggested method for burning the slots manually.

ing each pair of cuts, this speed resulted in an actual cutting time of 15 seconds per slot. Compare this with the speed of any machining method to produce slots of a comparable quality. Fig. 3 shows a close-up of the cutting torches in action.

In any operation involving heat, the control of distortion usually calls for due consideration. This job proved no exception to the rule. However, a sequence of skip-burning to distribute heat input was quite successful. After a pair of slots were cut down the entire pipe's length, the pipe was rotated 180 degrees for the second cut in the series. The third cut was made at 90 degrees to the second. This skip pattern was continued for the first group of 16 radial slots, with the fourth, sixth, and eighth cuts always made at 180 degrees from the preceding cut. After the entire pattern of 16 slots was completed, the operation sequence was repeated for the intermediate slots. How successfully was distortion controlled? The pipe showed a measured bow of about 1/32" down its length when finished and cooled! It was probably no straighter at the start of the operation.

This case problem was a jobbing operation—requiring only two filter pipes. Tooling was kept at a minimum. For quantity production of similar parts, an automatic flamecutting machine featuring multiple (4 to 8) torch operation could be considered. However, the average machine shop could not justify such an equipment investment. But the radiagraph represents a modest expenditure and the operation described could even be done with a rented oxy-acetylene outfit and a hand torch. Fig. 4 shows a suggested type of guide fixture that should prove adequate for a handtorch slotting operation. • • •

Retaining Oblong Punches

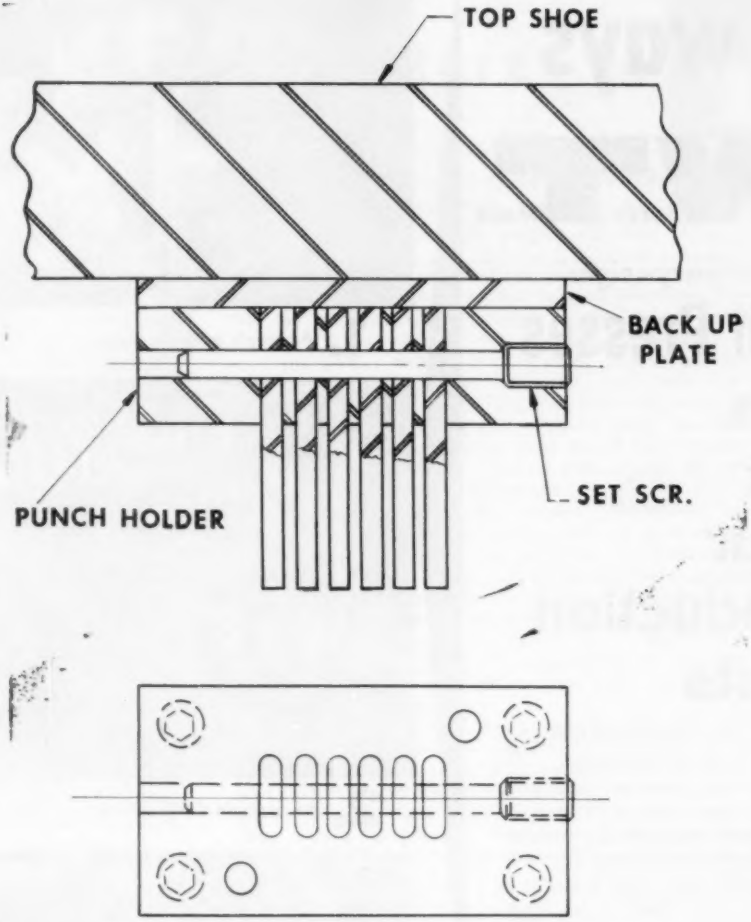
By **Roger Isetts**

■ When designing piercing dies for slotting closely spaced narrow oblong holes, retaining of the punches is often a problem. Elaborate, expensive methods with heels or special heads are not always practical, if at all possible.

Illustrated is a simply constructed arrangement that will effectively hold the punches rigidly in place without the danger of turning, and yet will facilitate sharpening and punch removal in case of breakage.

Each punch is made to the desired dimension for its full length. A hole is reamed in each one the same distance from the back end. The punch holder is cross drilled to receive an ordinary headless set screw which has been turned down leaving a short threaded portion equal approximately to 1½ times the thread diameter. The retainer is tapped about the same distance as the length of the thread on the set screw. This will bind the set screw by bottoming it in the tapped hole, preventing it from backing out when in use. It also eliminates the need for jam screws or lock nuts.

It can readily be seen that when a punch breaks, the whole retainer need not be removed from the shoe.



Suggested arrangement for holding punches rigidly in place.

In fact, the die need not be removed from the press. Because considerable breakage does occur with slender punches of this sort, to be able to replace punches quickly is a definite aid in lowering tool maintenance costs as well as preventing costly production delays. The set screw is removed, the broken punch slipped out, a new one put in and the set screw replaced.

It is a good idea, although not absolutely necessary, to provide a hardened and ground back up plate for the punches. The small additional cost involved is usually well worth it. • • •

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1. Industrial Saws and Cutting Tools are covered in four completely new and revised catalog sections. Heading the list of informative catalogs is the 32-page solid and inserted tooth circular saw section. It includes a section on proper selection of a saw, proper selection of saw gauge and number of teeth, and lists the most popular tooth styles for various types of saws. Other sections on wide and narrow band saws, metalcutting saws and machine knives help select the proper saw for the particular job. Disston Div., H. K. Porter Co., Inc., Philadelphia, Pennsylvania.

2. Redesigned Heavy-Duty Contour Machines, in four models, are described in catalog offered as showing versatility for filing, polishing and line grinding as well as band sawing of virtually all materials from asbestos to zinc. Four sizes are available—Models 1613-2, 3613-2, 2613-2 and 6013-02, with throat depths respectively of 16", 36", 26" and 60". All have 13" or more work height. Standard speed range for the first two models is 35 to 6,000 fpm, and for the other two, 25 to 5,500 fpm. The DoAll Co., Des Plaines, Illinois.

3. Precision Measuring Tools and Instruments. 96 fully illustrated pages provide detailed information on Scherr measuring tools and toolroom specialties such as a complete line of micrometers, vernier depth gages, snap gages, protractors, dial indicators, Ultra-Chex gage block sets, height gages, etc. The Carl Zeiss-Jena precision instruments are also presented. Worthwhile facts about each tool is given, with complete dimensions, diagrams where needed, and "how-to-use" information. Price list included. Scherr-Tumico, New York.

4. Automatic Positioning Systems for Cincinnati Gilbert horizontal boring, drilling, and milling machines are described in Bulletin 759. Completely independent of the feed mechanism, the Gilbert system uses either program bars, blocks, or end measures. The Cincinnati Gilbert Machine Tool Co., Cincinnati, Ohio.

5. Ovens and Furnaces. Reference catalog gives basic information about laboratory ovens, pilot plant ovens, small batch type production ovens and furnaces. It is designed to serve the needs of procuring personnel in the metal industries, electrical, chemical, food and institution industries. Each section contains specialized bulletins on each application of a particular oven. The Despatch Oven Co., Minneapolis, Minn.

FREE LITERATURE continued

6. Combined Feeding & Straightening Machines, Series 900 FS and 1000 FS, are explained in folder as automatically feeding pre-determined stock lengths to a press, shear or other machine, and then automatically straightening the material. Benchmaster, Gardena, Calif.

7. Expanding Turret Lathe Collet is presented in flyer as consisting of a master in all W & S types No. 1-No. 6 with machinable replacement mandrels from ¾"-6" dia. Specifications and prices are provided. The Dunham Tool Co., Inc., Danbury, Connecticut.

8. Metal Sawing Machines. Bulletin 6500 details information on the Peerless 6x6 Speedy-Cut in three models—the two-speed, variable speed, and three-speed. Sectional illustrations point up features such as compensating feeding mechanism, broad shouldered overarm, and heavy duty vise jaws and table. Peerless Machine Co., Racine, Wisconsin.

9. Disposable Tool Ends. As described in circular, disposable ends are investment castings, with a tolerance of .003. The End-O-Con ends are designed for cast iron work, End-O-Cut ends cut toughest steel, and End-X-Cel ends do heavy duty work. Ends Co., Indianapolis, Ind.

10. General Purpose Engine Lathes. Brochure supplies information on the very rugged C & J Master Model lathes in sizes of 16" or 18" swing, short, medium or long bed lengths. Advantages stressed were 5 hp motors at 1800 rpm, 12 geared spindle speeds, wide range of threads and feeds—48 separate threads 3 to 184 range, etc. The Carroll-Jamieson Machine Tool Co., Batavia, Ohio.

11. Stock Straightener. Folder explains the essential features of the Dickerman "Stock Straightner" such as: removes coil set, easily portable from one press to another, straightens blanked parts, etc. Illustrated are detail views of working parts. H. E. Dickerman Mfg. Co., Springfield, Mass.

12. Simplified Sequencing Method for JS air operated collet and indexing table fixtures is outlined in flyer as to how it works, with illustrations. James Smith & Son, Inc., Worcester, Mass.

13. Stainless Steel Cold Heading Wire is compared in brochure as to cost, corrosion resistance, and cold heading characteristics of the commonly used grades. Universal-Cyclops Steel Corp., Bridgeville, Pa.

14. Special Specification Cutting Tools. Literature tells how metal fabricators can get any type, size, or quantity of special tools needed with a saving of time and money. CTR Sales and Grinding Co., Chicago, Ill.

15. "T" Slot Bolts are described in flyer as manufactured of S.A.E. 4140 steel, austempered to a C scale Rockwell range of 42-45, giving tensile strength of 200,000 lb. psi. Diameters and prices included. Standard Parts Co., Bedford, Ohio.

16. Mercury Arc Lamp. Folder describes the J&L Mercury Arc Lamp unit as providing approximately five times the light intensity of the brightest tungsten fila-

(See Number 9)

(See Number 10)

(See Number 11)

NEW!

GREATEST CUT-OFF CAPACITY IN ITS CLASS!

• This newest addition to the Sever-All line of abrasive cutting machines—the Model 2-A—provides greater cutting capacity and more flexibility than any other machine in its class. Check these important advantages:

Big capacity • cuts 4″ round or square solids, 5½″ O.D. pipe or tubing, 6″x1″ flat stock, 6″ angle iron and 8″ channels. Cuts practically all metals. **Fast operation** • accurate cuts at rates of 2 to 3 seconds per square inch. **Power oscillation** • oscillation is the forward and backward motion of the cutting wheel as it is fed down into the cut. It provides extra cutting capacity, longer wheel life, cooler cutting and reduced operator fatigue. **Quality cuts** • clean, smooth cuts, require little or no finishing operation. **Economy** • Sever-All wheels, developed especially for the Model 2-A, provide lowest cost per cut.

VARIETY OF WORK HOLDERS GIVES UNUSUAL VERSATILITY

• Choose the work holders you need from several optional arrangements. These include the vise-type holder shown on the machine at top, plus the V-block, angle-cutting and 2-way clamp fixtures above. Screw-type and quick-action clamping interchangeable.

Write for details **on the new Model 2-A Sever-All abrasive cutting machine. Ask for Bulletin DH-299**

SEVER-ALL ABRASIVE CUTTING MACHINES

Allison-Campbell Division, American Chain & Cable Company, Inc.

937 Connecticut Avenue, Bridgeport 2, Conn.

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ACCO

ment lamps. Unit is designed for J&L 14" and 30" screen comparators, old or new. Jones & Lamson, Springfield, Vt.

17. Abrasive Belt Grinders are presented in flyer as grinding, deburring and polishing metals, rubber and plastics, for use at approximately 6,000 to 10,000 sfpm. Models with specs. and prices included. Burr-King Mfg. Co., El Monte, Calif.

18. Sintered Metal Parts. Bulletin treats the process of producing sintered metal parts, their physical characteristics, mechanical properties, economies, and applications. Burgess-Norton Mfg. Company, Geneva, Ill.

19. Gages. Colorful brochure covers the Econ-O-Check gaging line, with sizes, prices and ordering instructions. This line comprises taperlock thread plug gages (single end- double end-members only), thread ring gages (go or no go), thread setting plugs (truncated type), reversible thread plug gages, and plain cylindrical plug and ring gages. Reliant Gage & Supply Co., South Gate, Calif.

20. Automatic Bar Feed. The Holdridge E-Z-Air is reported as operating simultaneously with the collet closer while the lathe is running. Literature also provides specifications of holding and feeding bar stock of 1" and smaller dias. Three tube sizes accommodate 3', 4' and 6' pieces of stock. Holdridge Manufacturing Co., Los Angeles.

21. Mounted Wheels. Bulletin available illustrates all mounted wheels full size, with exact dimensions and prices. There are 200 standard sizes and 86 standard shapes available in a variety of bonds, including vitrified, resinoid and soft rubber polishing. Chicago Wheel and Manufacturing Co., Chicago, Ill.

22. Automatic Lubricant Dispenser. Logan's A-L-D unit is described in flyer as a multi-purpose automatic lubricant dispenser designed to automatically dispense fluids and semi-solids in predetermined volumes. Logansport Machine Co., Inc., Logansport, Ind.

23. Aircraft Drills. Literature describes a new series of drills, made of 8% cobalt high speed steel, designed for production drilling of hard materials now used in the aircraft and missile industries. Of jobbers length, sizes are available from 7/64" through 3/8"; No. 1 through No. 40, Letter A through U. Whitman & Barnes, Plymouth, Mich.

24. Carbide Router Bits. Folder presents Sonnet standard tungsten carbide router bits for use on aluminum, plywood, acrylic plastics, Bakelite, resin-based plastics, etc. Sizes and dimensions are given. Sonnet Tool & Mfg. Co., Hawthorne, Calif.

25. Bending Machines. Circular provides condensed data on the seven standard models of Pines rotary-type bending machines for tubing, pipe, extrusions and rolled sections. Illustrations show typical applications. Pines Engineering Co., Inc., Aurora, Ill.

(See Number 19)

(See Number 20)

(See Number 21)

Landis Universal at Angelus Sanitary Can Machine Co., Los Angeles, California

Buck chuck teamed up *right* really pays off

Take a *good* machine . . . complement it with a Buck chuck . . . and *you make money every time!*

The job above was grinding O.D. and I.D. of tool steel bushings. The flexibility of the machine plus the precision of the Buck cuts grinding time in half! Tolerance of ± .0005" was no problem for the buck.

Make any comparison you want . . . there is no other chuck with the quick, adjustable, precision capabilities of Buck Ajust-Tru® chucks. Send for a catalog—see why "It pays to chuck with Buck."

Makers of Scroll, Power, Dust Proof, Independent Chucks.

BUCK TOOL COMPANY

1212 SCHIPPERS LANE • KALAMAZOO, MICH.

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FREE LITERATURE continued

26. Disposable Odor Filter. Literature describes AAF's new disposable activated carbon odor filter as combining high-efficiency odor removal with a high degree of air cleaning in one low-cost, disposable-type unit. Four standard sizes are offered, to fit standard 2" frames. American Air Filter Co., Inc., Louisville, Ky.

27. Boring, Drilling & Tapping Machines. New Sundstrand multiple spindle precision boring, drilling and tapping machines, as described in brochure, are available in two models with either an 18"x36" head or a 9"x14" head. They are designed primarily for work with nonferrous metal parts. Typical performance data is provided, as well as specifications and dimensions. Sundstrand Machine Tool, Div. of Sundstrand Corp., Belvidere, Ill.

28. Mechanical Sleeve Clutch OBI's. Niagara's redesigned line of Series A inclinable presses, featuring an exclusive multi-point mechanical sleeve clutch, is covered in 28-page Bulletin 58N. A complete description of standard and optional features, specifications, die space dimensions, strokes and shut heights are included. Niagara Machine & Tool Works, Buffalo, N.Y.

29. Groove and Deep Bore Gages. Leaflets include Mueller's line of groove gages, adjustable depth and groove location gages, groove measuring comparator, various types of indicators, bench comparators and bore gages. These gages are reported to simplify difficult gaging situations and permit use by unskilled help. Mueller Gages Co., Pasadena, Calif.

30. Numerically Controlled Milling. Catalog pinpoints the Numeric-Keller as designed and equipped especially for continuous, automatic contour milling under direction of a tape-reading numerical control system. No guiding template or model of any kind is needed. Operator's responsibility is reduced to setup and tool changes. Case histories of the machine's achievements are given, as well as illustrations and descriptions of parts, cutting tools, tape preparation and processing. Pratt & Whitney Co., Inc., W. Hartford, Conn.

31. Surface Plates. Offering precision flatness, AccuRite's black granite surface plates are described in literature as maintenance-free, rust-proof and moisture resistant. How the plates are made is discussed. Service is offered on refinishing and special requirements. Accurite Surface Plate Co., Los Angeles, Calif.

32. Threading. "Thread Tips" for Sept. 1959 discusses large diameter threading in a fraction of a second, how Landis keeps threading equipment looking new, and a new multi-cut tap for rotary applications. Published by Landis Machine Co., Waynesboro, Pa.

33. Newly Revised "Valve Finder" now includes minimum and maximum capacity coefficients (C_v) for Hannifin's complete

(See Number 28)

(See Number 29)

(See Number 30)

UNIVERSAL JIG AND FIXTURE COMPONENTS AND CLAMP ASSEMBLIES

Shown here are a few of more than a thousand different items in regular steel and stainless steel—the largest and most complete selection in the United States—now available from Universal Engineering Co. Write today for your copy of the complete, new catalog.

213

OTHER PRECISION-BUILT COST SAVING UNIVERSAL PRODUCTION TOOLS

Floating Chuck

Standard Collet Chuck

Mikro-Lok Boring Bar

Boring Chuck

"Kwik-Switch" Tool Holder

Standard Drill Bushing

Wedge-Lock Production Vise

UNIVERSAL ENGINEERING COMPANY, FRANKENMUTH 10, MICHIGAN

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FREE LITERATURE continued

line of directional air control valves. This new rating allows instant selection of the correct air valve for any installation. Hannifin Co., Des Plaines, Ill.

34. Socket Screw Products. Literature covers socket head cap screws, set screws, button heads, flat heads, shoulder screws and socket screw keys, as well as Unbrako precision dowel pins, pressure plugs, and square head set screws. Reported as economically priced, they offer ultimate tensile strengths as high as 200,000 lb. per sq. in. Standard Pressed Steel Co., Jenkintown, Pa.

35. Thread and Cylindrical Gages. Precision thread and cylindrical gages, standard and special, including Acme, Buttress, metric and multiple lead, in steel, carbide, or Lincaloy chrome are discussed in 22-page catalog. Well illustrated with charts of specifications. Lincoln Gage Co., St. Clair Shores, Mich.

36. Speed-Draw Presses. Catalog No. 2029-A gives construction details and complete specifications for Steelweld speed-draw presses in capacities from 200 tons to 1,250 tons. Diagrams depict the patented mechanism reported to provide an operating speed 80% over that of standard mechanical presses. The Cleveland Crane & Engineering Co., Wickliffe, Ohio.

37. Vises, Chucks and Dividing Heads. Illustrated and described in recent catalog is a full line of milling machine and drill press vises, dividing heads and attachments, and lathe and magnetic chucks, demagnetizers and rectifiers. L-W Chuck Co., Toledo, Ohio.

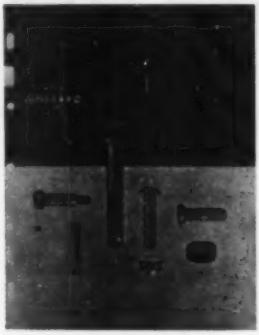
38. Box-Type Electric Furnaces. 12-page Bulletin No. SEC-3 describes Sunbeam's line of box-type electric furnaces. Sunbeam Equipment Corp., Meadville, Pa.

39. Relay Control Amplifier. The new high-gain DC to AC relay control amplifier is described in bulletin which gives detailed information concerning principles of operation, performance ratings, and applications. Thermo Electric Co., Inc., Saddle Brook, N. J.

40. Special Alloys. Technical Data Bulletins list specifications of special alloys and details the metals processing services offered. Included are general characteristics, physical constants, heat treatment and properties of alloys such as Alfenol, Havar, and Elinvar Extra. Precision Metals Div., Hamilton Watch Co., Lancaster, Pa.

41. "Ross EnginAIR" is published bimonthly by Ross Operating Valve Co. of Detroit. Articles relate how air has aided machine builders and operators, and the operation of air valves.

42. Permanent Magnets. Engineering bulletin describes in detail the magnetic and material characteristics of Hyflux Alnico V-7, as well as many applications. It is reported to be the first commercial permanent magnet material to achieve typical energy product values of seven



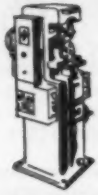
(See Number 34)

(See Number 35)

(See Number 36)

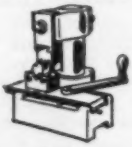
General purpose Roll-Marking Machines

Rapid production Roll-Marking Machines



Precision Graduating Equipment

Mechanical and Pneumatic Marking Presses



Bench Marking Machines

Automatic Numbering Heads

Precision Marking Dies

Hand Marking Tools

Permanent METAL MARKING

For over half a century Noblewest has been the leader in designing and building machines and tools for faster, better marking at lower production costs to users. Noblewest marking is *permanent indented marking* . . . good for the life of your product. Illustrated are the basic types of marking equipment in the Noblewest line. It includes machines for marking, graduating, embossing and serial numbering at production speeds up to 15,000 pieces per hour with full automation. Whatever you want to *permanently* mark, it will pay you to specify NOBLEWEST. Write for comprehensive catalog. Noble & Westbrook Manufacturing Company, 9 Westbrook Street, East Hartford 8, Connecticut.

A few desirable territories open to qualified representatives.

MARK IT BEST WITH NOBLEWEST IMPROVED MARKING DEVICES

NOBLEWEST

MARKING
NUMBERING
EMBOSSING
GRADUATING

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million (BHmax). The Indiana Steel Products Co., Valparaiso, Ind.

43. Filter Elements. Applications and characteristics of Series 2200 Microbon Ribbon fluid filter elements are provided in Brochure No. 44, which is illustrated with photographs, drawings, curves and tables. Standard sizes and tolerances available in Microbon are given. Bendix Filter Div., Bendix Aviation Corp., Madison Heights, Mich.

44. Single and Multiple Rivet Setters. A complete line of these setters, which are air powered and air cushioned in operation, are presented in a bulletin released. Air operation permits use of semi-tubular rivets for fastening fragile materials in conjunction with metals. Chicago Rivet & Machine Co., Bellwood, Ill.

45. Die Cushions. 16-page catalog covers the Verson line of die cushions. Described are pneumatic, hydro-pneumatic and hydraulic types. Size and capacity data is given as well as information on typical die cushion arrangements. Verson Allsteel Press Co., Chicago, Ill.

46. Hydraulic Press Brakes. The line of Chicago hydraulic press brakes is presented in 12-page catalog, which details the construction and operating features of 55 standard models. Several typical installations shown perform a variety of sheet metal and plate bending operations. Optional features are available as extras. Dreis & Krump Mfg. Co., Chicago, Ill.

47. Optical Flats. Data bulletin illustrates increased size range as well as optical flats with holes, coatings, and parallels. Many of the standard prices are lower on this new price list O.F. 8-59. Acme Scientific Co., Chicago, Ill.

48. Copying Equipment. A handy file-folder catalog covers Cormac's copying equipment for the coming year. Two items are introduced: The Cormac Golden Corvette with Flo-Matic Control and the Cormac 500, a single-step photocopier. Flo-Matic Control is Cormac's automatic filling and draining feature. Cormac Photocopy Corp., New York City.

49. Welding Wires. A newly revised edition of Air Reduction's Aircomatic welding wire pocket guide has been published. This 84-page booklet includes the latest information on Airco's complete line of gas-shielded metal-arc welding wires, including data on the improved A675 steel wire, and the new A666 steel and A556 aluminum. Air Reduction Sales Co., Div. of Air Reduction Co., Inc., N.Y.C.

50. Concentrated Liquid Wetting Agent, Macro Wet 1, is described in Technical Data Sheet No. 94 as particularly intended for use in strong oxidizing (chromic and nitric acid) solutions. It is effective in all chromate processes for zinc, cadmium, silver and aluminum. MacDermid Inc., Waterbury, Conn.

(See Number 44)

(See Number 45)

(See Number 46)

ON YOUR PRODUCTION LINE

Get pressure where you need it with a

HANNIFIN
FORCING PRESS

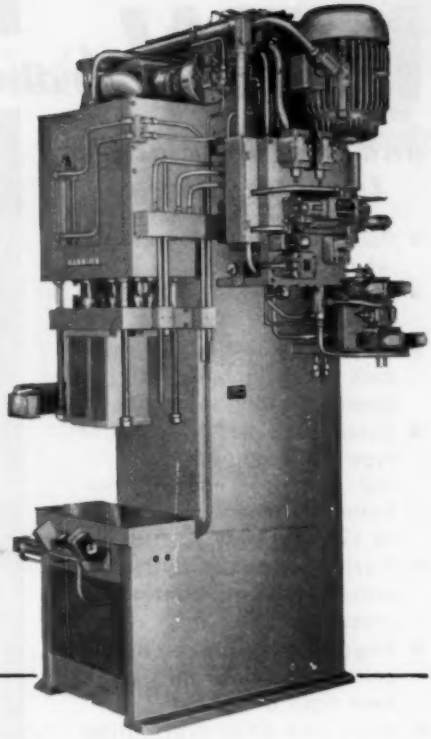
150 TONS to 1 TON

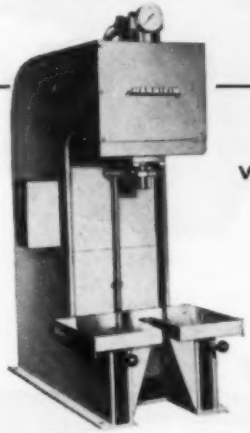
•

GAP OR COLUMN TYPES

•

HIGH SPEEDS • LOW PRICES





WITH THESE FEATURES:

1. All-steel welded frames—normalized.
2. Steel-head, heavy-duty cylinders.
3. Induction case-hardened rams.
4. Wide choice of ram speeds.
5. Built-in power units.
6. Wide choice of controls.
7. Special loading and unloading mechanisms where needed.

Call in your nearby Hannifin man—he's a trained production analyst—find out how you can do more at lower costs with Hannifin presses. Or, write for our new Bulletin 130-G. It tells the whole story.

HANNIFIN COMPANY

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A DIVISION OF PARKER-HANNIFIN CORPORATION

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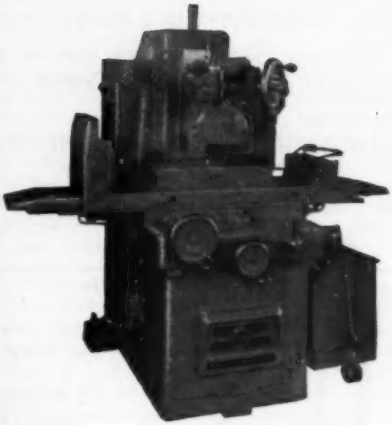
NEW *from* GRAND RAPIDS

No. 350 PRECISION TOOL ROOM TYPE HYDRAULIC FEED SURFACE GRINDER



and just look at all these features:

- Powered vertical movement of wheel head*
- Instantly variable hydraulic table speed
- Greased-for-life precision ball bearng spindle with two speeds for long wheel life
- Equipped with Vickers vane type pump and our own control valve for infinite longitudinal table speeds from 5" to 120' per minute
- Variable speeds hydraulic cross feed and continuous cross feed
- Rugged, one-piece casting column and base for permanent rigid alignment
- Bijur one-shot lubricating system eliminating hand oiling
- Ultimate in accuracy with micro inch finish at production speeds

* ***AUTOMATIC DOWNFEED AVAILABLE AS OPTIONAL FEATURE***

For full details, just send a note on your letterhead.

GALLMEYER & LIVINGSTON

GALLMEYER & LIVINGSTON CO.
406 Straight Ave., S.W., Grand Rapids, Mich.

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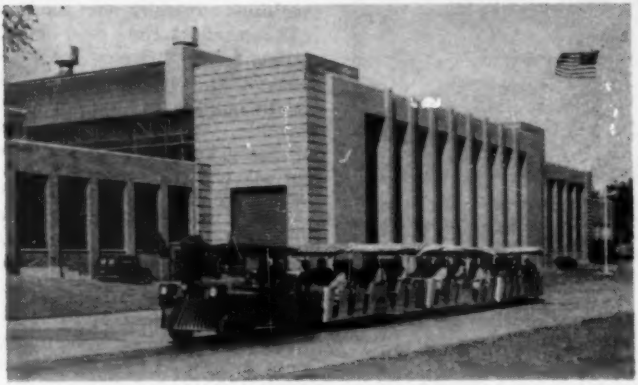
news of the industry

15



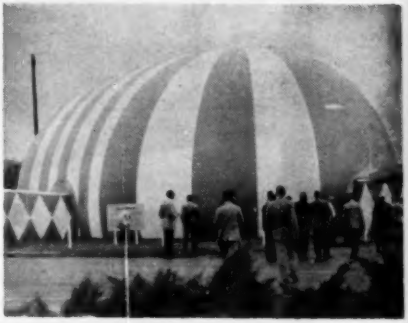
Train carrying some of the guests at the "Adventures in Progress" 75th Anniversary observance of Cincinnati Milling Machine Company passes "the Mill's" foundry building.

BIG "UNVEILING" OF MACHINE TOOLS AT CMM CO.'S 75th ANNIVERSARY SHOW

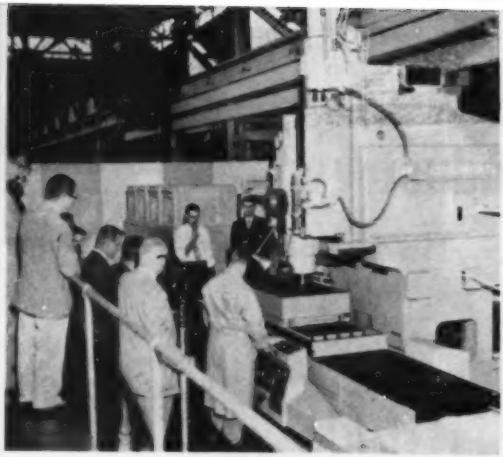
Cincinnati—More than 20 new machine tools designed to help industry "break the cost barrier" were demonstrated here by The Cincinnati Milling Machine Company on Oct. 5. The largest American builder of machine tools chose its 75th anniversary celebration for what is believed to be the biggest "unveiling" ever presented by a machine tool firm.

Frederick V. Geier, chairman of the board, told guests that "our very survival as a nation depends in large part on progress in machine tools."

With 87 individual demonstration machine tools in operation, CMM Co. took visitors on a day-long "Adventures



Exterior of air-supported "Cimasphere." Red-and-white bubble tent is 88 feet long, 60 feet wide, 34 feet high.



Guests at "Adventures in Progress" watch numerically controlled 30 x 52 inch vertical Hydrotel milling machine. Eighty-seven machine tools were "under power" in demonstrations.

in Progress" tour of its Cincinnati installation.

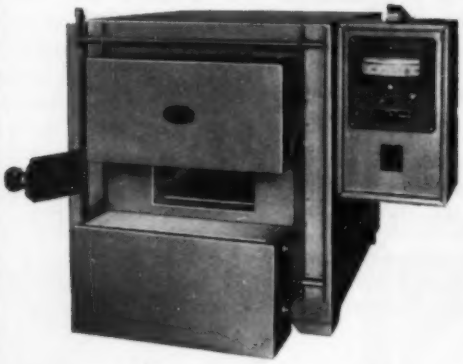
They saw a new Intraform machine over 200 feet long, used to fabricate precision tubing of both ferrous and non-ferrous materials. The tour ended inside a large red-and-white-striped "Cimasphere"—a plastic "bubble tent" held up by interior air pressure, erected on the firm's campus-like grounds. This was the scene of a "political convention"—at which the cost-cutting machines naturally won the nomination.

Throughout the day, guests were confronted with new and sometimes spectacular technological developments. In the numerical control center, for example, they saw seven machines, all being operated by Acramatic numerical control systems built by The Cincinnati Milling Machine Company.

Visitors were introduced to the bubbling sound of "electrical discharge machining"—a field which "the Mill" now has entered with full force and a line of 33 Elektrojet machines.

In this kind of machining, metal is cut or eroded by an electrical spark. This takes place within a liquid-filled tank; hence the bubbling sound.

the new BIG bench-type furnace for heavy production heat-treating



An all-new TEMCO electric furnace specifically designed to let you heat-treat more **and bigger** parts in a bench-type unit. **Larger chamber size** . . . 10" W, 9½" H, 22" D. **Higher temperature range** . . .continuous up to 2000° **and** 2300°F (1095° and 1260° C) . . . **handles most high-speed steels.**

This new Type 1800 TEMCO furnace features a close-sealing sectional door with patented lever suspension to provide limited or full access as desired. Reinforced welded steel case . . . 7½" firebrick and backup insulation. Choice of single or three-phase models, for 208, 230 or 460 volts. Available with or without controls. $685 to $745 furnace only.

Write for free literature and name of nearest dealer.

TEMCO

ELECTRIC FURNACES

Thermo Electric Mfg. Co.

486 Huff Street, Dubuque, Iowa

Use postpaid card. Circle No. 301

Viewing a new metal forming machine of the Mill's Meta-Dynamics Division — which "squeezes" metal rather than cutting it—the visitors were told that: "We feel that we really know what happens to metal in forming and spinning."

The Products Division showed off its 256-foot kiln, used in the manufacture of precision grinding wheels. Here it takes a car of grinding wheels six days to pass through the kiln, where the temperature reaches 2300 degrees Fahrenheit.

For businessmen bedeviled by inflation, a CMM Co. associate company, Cincinnati Lathe and Tool Co., added an economic startler to the technical news. CL&T demonstrated a new lathe, which actually sells for $512 less than its 1950 counterpart!

One act in the day-long show started out with the cave man's effort to draw a circle (after Cave Man Jr. says: "Pop, why don't you invent a wheel?"). History then rushes along to the present, and the need for extreme precision in producing roundness. Visitors then saw demonstrated new Cincinnati and Heald precision grinding and finishing machines.

Other innovations included a new general purpose milling machine, new developments in hardening of metal through induction heating, a machine for sharpening cutting tools which operates automatically, and a new super precision grinder which will grind mating parts to fit within a few millionths of an inch.

Amidst the array of scientific and technological advances, the Mill—now a world-wide organization—took a brief nostalgic glance backward to its beginning in Cincinnati, down by the Ohio River, in 1884.

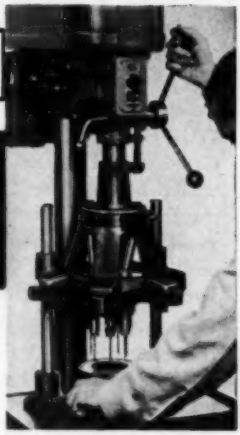
That was the year, it was noted, when the U.S. Commissioner of Labor solemnly stated: "There is no further room for marked extension of industry."

ETTCO-EMRICK

Knuckle-heads

fully adjustable for dependable multi-hole drilling and tapping

5 models to choose from — circle or straight line types



- Chrome nickel universal ball joint type spindles.
- Adapt to any drill press or drilling or tapping unit or machine — Operate in any position.
- Quickly convertible for either drilling or tapping on any drill press.
- Lubricated ball joints with neoprene covers — an Ettco exclusive.
- Tap or drill capacities up to ⅝" in steel.
- Precision built, lightweight and compact.

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596 Johnson Ave. Brooklyn, N.Y.

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HEAVY DUTY

• GRINDERS • DISC GRINDERS and BUFFERS

We know what goes into these Grinders and Buffers! That's why we can make this offer.

Point for point – you just can't beat QUEEN CITY Heavy Duty Disc Grinders and Buffers. Built to stand up under hardest use . . . heavy duty motors deliver full horsepower. Wheels, guards, switches, cords, eyeshields are of highest quality . . . selected to deliver long, trouble-free service.

Choose from a complete line of floor or bench types . . . in sizes from ½ to 10 H.P. and buy them for 20 to 30% under competing makes. Try them for 30 days on money-back guarantee!

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"Known for Quality for Over 50 Years"

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M & M Tool & Mfg. Co. Held 4-Day Tool Show

Showing the new Roto-Spacer at the tool show are left to right: D. B. Millat, vice president and sales manager, and sales representatives, Robert Davis and Wm. Daniel.

"Profits Through Automation and Machine Applications" was the theme of the four-day machine tool show, Sept. 22-25, conducted by the M & M Tool & Mfg. Co. of Dayton, Ohio. Introduced for the first time at this show were many new products now being manufactured by the firm.

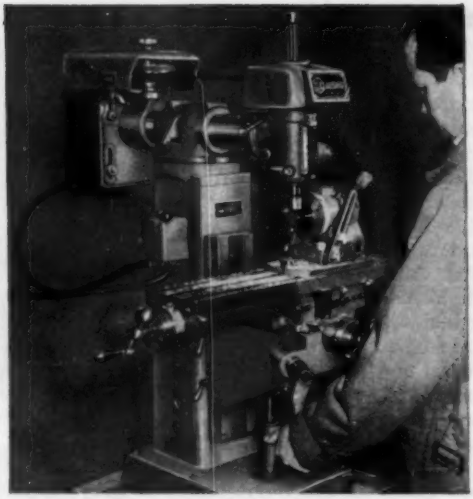
The show featured the new Roto-Spacer capable of indexing 6,500 times per hour, used in assembly, drilling, staking and other operations. Other products featured were the new Roto-Grind which is capable of grinding large rings 16" dia. to 50 millionths, and the new Roto-Torque which is a special power attachment for hand-operated machines.

Attendance included representatives of aircraft and general manufacturing industries as well as foremen, purchasing department agents and engineers from many local plants.

HERE'S PROOF OF PERFORMANCE . . .

"The Clausing Vertical Miller is the best machine for the money on the market today! It is most versatile . . . and extremely accurate".

— F. L. BALLENTINE, EMPIRE TOOL ENGINEERING COMPANY, INC.



The high precision spindle and drive have 7 ball bearings . . . hardened spindle. Ground and hard chrome plated quill has full length bearing in head.

The spindle head can be swiveled in a vertical plane and set at any angle, and turret rotated in a horizontal plane making it possible to machine at all angles with one set-up.

This report is typical of the experience of users everywhere. The CLAUSING VERTICAL MILLER is a precision machine tool designed for operations where "extremely accurate" machining is required. And, it is an outstanding producer, "most versatile, easiest to set up, get around and operate of *any* miller at or near its low price." **Only $875 f.o.b. factory.**

VERIFIED ACCURACY— Before it leaves the factory each CLAUSING Mill must pass rigid tolerance tests such as:

1. Top of table perpendicular to column ways within .0005" in 6" travel.
2. T-slots square with cross slide dovetails within .0005".
3. Table, parallel to turret within .001".
4. Spindle square with table, front to rear, within .001" T.I.R. in 5" circle.
5. Spindle taper (internal) run out within .0002" at spindle nose.
6. Table T-slots parallel to table dovetail ways within .0005" in 8" longitudinal travel.

MILLS, DRILLS, BORES, REAMS, SHAPES AT ALL ANGLES . . . WITH ONE WORK SET-UP!

Atlas CLAUSING PRECISION MACHINE TOOLS — DIVISION ATLAS PRESS COMPANY

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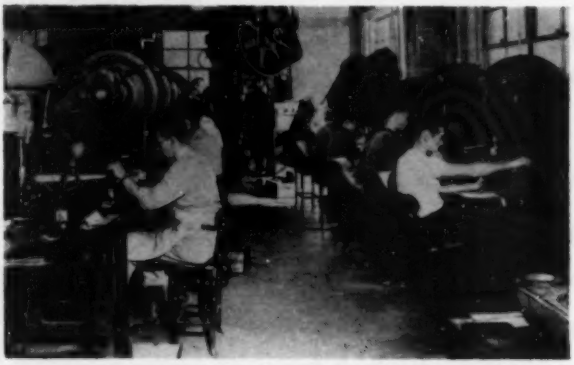
Risks Eliminated In Tooling For Mobile & Marine Products

The risks involved in tooling for new mobile and marine products are being eliminated by the use of Federal rapid-phase tooling and production methods. Available from Federal Tool and Manufacturing Co., 3712 Alabama Avenue, Minneapolis, Minn., it provides an opportunity to test both market potential and new product design before setting up expensive permanent tooling.



Tooling costs are reduced since new tooling is required for only a minor part.

The rapid-phase method breaks tooling down into individual stamping operations often performed on individual presses. This makes it possible to use tools and dies already in stock, so that new dies are required for only a minor part of the tooling.

Production by this method is the same as that used for later production runs, so that later models are exact duplicates. Specs. available include maximum size of 14"x20", ⅜" thick and up to 400 ton pressure. Plants are located in Minneapolis, Rochester, N. Y. and N. Hollywood, Calif.

E. F. Vilter Co. Sells Attachments to Zierden Co.

The E. F. Vilter Co. of Milwaukee, Wis. has sold its line of machine tool attachments to The Zierden Co. of 3815 S. Kinnickinnic Ave., Milwaukee. The attachments are sold under the "Tru Hole" trademark and consist of "Speedy" drilling attachments, Sensitive Feeding Attachments for turret

JEMCO ELECTRIC HAND SHEARS and NIBBLERS

In use by major industries for over 25 years

10% Greater Efficiency—10% Lower Cost

Nibblers supplied with either standard or with right angle heads to cut corrugated metal.

Nibbler capacities—
18 gauge; 14 gauge and 11 gauge
Shear capacities—
7 gauge; 12 gauge; 14 gauge and 16 gauge

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Send for FREE 32-page catalog showing complete line of styles and sizes.

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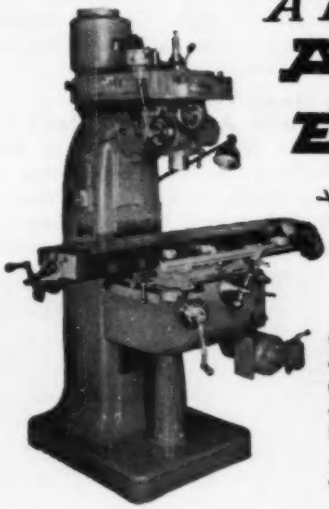
A Lot More
ACCURACY
ECONOMY too!

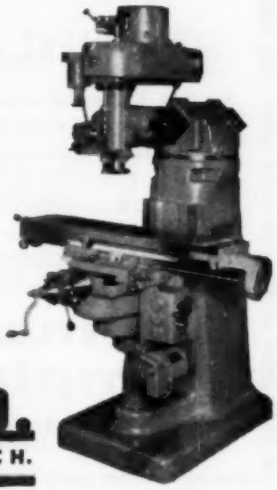


INDEX "SUPER 55" VERTICAL MILL

● 1½ HP Head or optional 2 HP with continuous duty motor gives 50% or more capacity . . . More rigidity, more accuracy . . . Increased horse power and dynamically balanced Cast Iron Pulleys and Drive System afford improved production capacity . . . More weight in the column, heavier ribbed column, heavier knee, heavier saddle.

INDEX "45" VERTICAL MILL

● Unique square design of overarm affords more rigidity, greater accuracy . . . Provides extra range and capacity . . . More power at the cutter. No adjustment required on overarm and head after use . . . No need to re-indicate head after moving overarm . . . Speed range with nine changes makes possible the use of high speed or carbide tipped cutters to best advantage.



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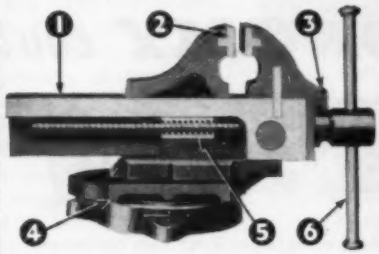
1. exclusive steel slide milled from solid bar
2. replaceable jaw inserts held by top-entering pins
3. outside screw retainer



4. positive locking 360° swivel base
5. longest wearing alloy steel nut
6. one-piece non-pinch handle

SOLID STEEL SLIDE

Simplex industrial vises give you the advantage of solid steel slides, jaws, nuts for maximum strength and ruggedness long after their modest cost is written off. Line includes milling machine, pipe, sheet metal and other models.

Desmond Simplex

The Desmond-Stephan Mfg. Co.
Urbana, Ohio

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lathes, small diameter adjustable, carbide tipped boring tools, spring loaded telescoping center for precision hand tapping operations and a device for aligning or indexing holes, keyways, etc. on very long workpieces.

The Zierden Co. manufactures a line of turret heads to be used primarily with engine lathes.

The acquisition of the tool line will enable The Zierden Co. to expand their sales coverage, and offer a more complete line of attachments.

Ipsen Heat Treat Unit Installed in Ace's New Plant

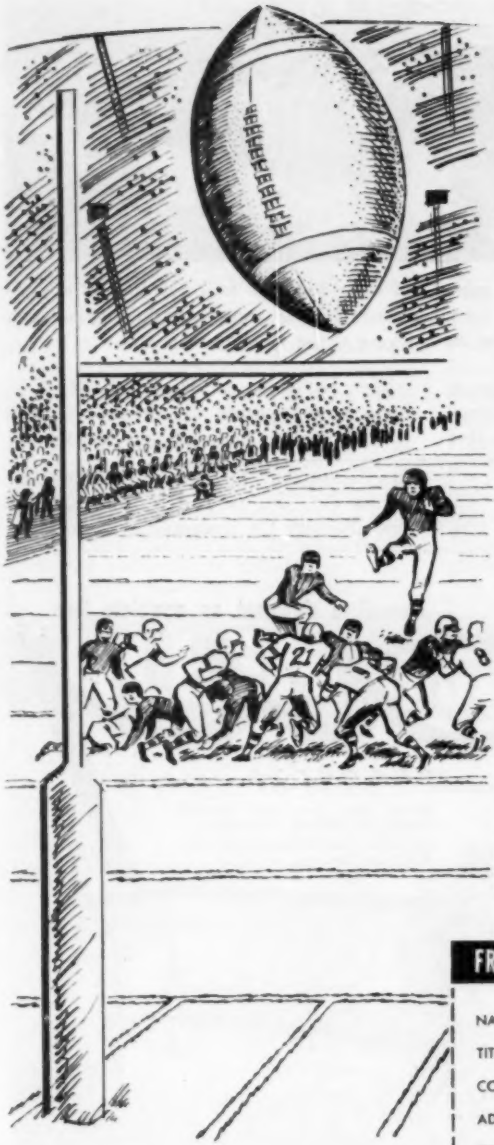
The new West Coast plant of Ace Drill Bushing Co., Inc., Los Angeles, at Arlington, Calif., devoted to the manufacture of Ace drill bushings, has installed Ipsen automatic heat treating

equipment along with many other new features in its new 26,000 sq. ft. facility.

Choice of an electronically-functioning Ipsen unit was based on its high batch-to-batch uniformity of heating every part of the charge, whether parts are light or heavy. It was also reported that controlled atmosphere assures bright, scale-free results requiring neither blasting nor pickling.

Pressure Blast Acquires New Division

Pressure Blast Mfg. Co., Inc. of Manchester, Conn., has acquired the Sand Blast Division of Leiman Bros. Co., Newark, N.J., to complement its regular line of wet blast equipment and abrasives.



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Acme Industrial Company for over 40 years scored unerringly with precision, capacity, and its "person to person" customer relationships.

Just as in any sport the ingredients for success are versatility, capacity, accuracy and ingenuity, Acme has proven time and again to have the right ingredients.

Acme's modern plant contains over 300 metal working machines and 200 pieces of laboratory testing and inspection equipment for maintaining tolerances from .001 to .00001 inch. Being specialists in hydraulic actuating cylinders and pistons, Acme's contract, research and development work are designed to meet the Industrial Security Board's requirements.

Acme can produce any part, one or a million, any finish, hardened and ground, or assemblies in ferrous or non-ferrous materials to order from your specifications.

Why accept second best, only Acme Industrial is first in the field of custom precision manufacturing.

Send your blue prints and specifications for quotation.

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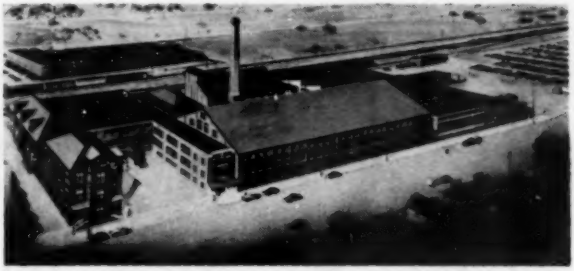
H. K. Porter Co., Inc. Acquires Peerless Electric



The former Peerless Electric Co. of Warren, Ohio, has become the Peerless Electric Division—the fourteenth division of H. K. Porter Co., Inc., diversified Pittsburgh-based industrial concern.

Ralph Kroehle, chairman of the Board, began with Peerless in 1927. He will continue with Porter as a consultant. **S. C. Powers**, who has been president of Peerless, will continue as the Division manager.

Peerless is a major supplier of custom built electric motors to the original equipment market, and also has a line of fans, blowers and ventilating equipment. Porter plans further expansion along these lines.

The Divisions of H. K. Porter Co., Inc., now operate 51 plants in the United States, Canada, and Mexico.

The Dumore Co. Purchases Master Manufacturing Co.

The Dumore Co. of Racine, Wis. has acquired the Master Manufacturing Co., Inc. of Hutchinson, Kansas. The Dumore Co. manufactures portable

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immediate shipment on complete line

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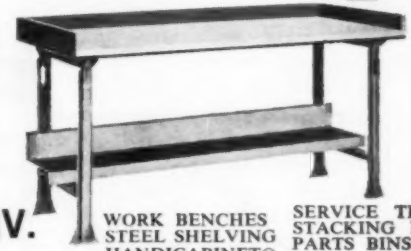
Specify BAY, the finest value in steel equipment, and be sure of receiving products which are designed properly—produced properly—unconditionally guaranteed. And you will receive them quickly!

OUR RECORD: Over 15 years satisfied use by leading national companies.

THE REASON: Our equipment is its own best salesman.



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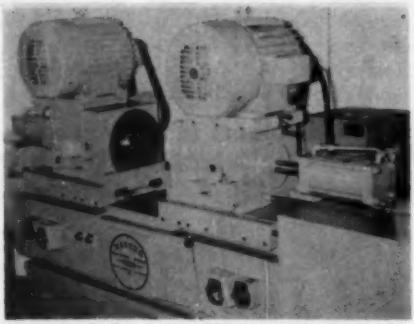

Typical of the larger Master products is this automatic duplex boring-facing machine.

precision tools for milling, drilling and grinding ferrous and non-ferrous metals as well as plastic and glass, while Master has specialized in the building block component type of machine tool. According to **Robert Hamilton**, president of Dumore, the products of the two companies complement one another. With the Master facility, larger products can now be built.

Officers of the newly organized company are **Hamilton**, chairman of the board; **George E. Shoup**, president; **Don Morton** and **Howard Anderson**, vice presidents; **M. E. Hamilton**, secretary, and **Marion H. Toland**, treasurer.

Magnaflux Corp. Becomes Subsidiary of General Mills

As of October 31, General Mills, Inc., acquired the business of Magnaflux Corp., Chicago, which will operate as a subsidiary without change of name.

General Mills has widely diversified operations, including its industrial group specializing in the mechanical, electronic, and chemical fields. The divisions of this group are backed by extensive facilities and personnel for research, both fundamental and applied. With this added technical backing, Magnaflux' progress in developing new and improved nondestructive testing methods to solve the customers' problems will be accelerated.

F. B. Doane, one of Magnaflux'

ALLEN HEAVY DUTY PUNCH PRESSES

Moderate in Price

Powerful Dependable and Economical Fully Guaranteed

Hundreds of different Model Combinations 1 to 12 ton Capacities

See your Supply Dealer or write for catalog giving complete information, specifications and prices on our line of Heavy Duty Punch Presses.

Model BT-12 12 Ton—$437.50 less motor—fob

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ORIGINATORS OF "GROUND-FROM-THE-SOLID" DRILLS

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founders and president, retires from active management after 30 years with the firm, but remains as a consultant. Otherwise, the Magnaflux organization and personnel remains intact.

Two Presidents in One Company

These are two presidents of national trade associations. Jack Kleinoder, left, and Fred F. Rimmler, executives of Volkert Stampings, Inc., Queens Village, L.I., New York, are heads simultaneously of two important associations of which their company is a member. Kleinoder, secretary-treasurer of Volkert, served as president of the National Tool & Die Manufacturers Association during the past year, and Rimmler, plant manager, has just been elected president of the Pressed Metal Institute. NTDMA is composed of over 1000 leading tool and die companies located throughout the U.S. PMI consists of over 250 metal stamping shops and their suppliers throughout the world.

HARCO STANDARD FIXTURE CLAMPS AND DETAILS

Save Tool Room Time!

Precision-machined, hardened, rust-proofed. Fast delivery from stock! Cut design time, increase tool room production and save many man-hours by specifying STANDARD HARCO FIXTURE CLAMPS AND DETAILS.

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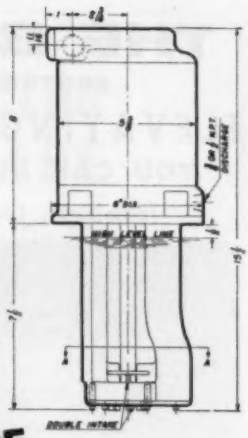

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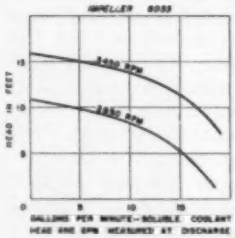
Designed right, with all the experience that has made Ruthman Gusher Coolant Pumps the leader in their field, Baby Gushers are ideal for machines requiring a nominal volume of coolant.

✓ ECONOMICAL PERFORMANCE



Your Baby Gusher will give you excellent and economical performance on your metal cutting equipment. Pumps up to 25 gallons per minute at 15 foot head. Uses less power when throttled—requires no priming. Coolant flow starts instantly.

✓ LONG LIFE AT MODERATE COST

The original cost of your Baby Gusher is moderate . . . maintenance cost is at an absolute minimum. Pre-lubricated ball bearings need no further attention. No packing or seals. There are fewer parts to wear. No metal to metal contact.

Model 6-P-3 IMMERSED TYPE

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2000 LBS. OR *1000 LBS. CAPACITIES
*ILLUSTRATED

A precision made
MIDWEST TABLE
Costs no more!

- It's hydraulic . . . positions work or feeds at desired height without use of hands
- Rigid cast construction
- Top turns 360° and clamps
- Foot release valve
- Machined top surface can be used as work table
- Roller bearing casters with ball bearing swivels
- Floor clamping available extra

Write today . . . specials on request

MIDWEST

112 WEBSTER ST., DAYTON 2, OHIO
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Warner & Swasey Builds New Research Center

The Warner & Swasey Co.'s new 40,000 sq. ft. research center will be located on Aurora Rd. in Solon, Ohio, east of Cleveland. Completion is expected late this year, with dedication in 1960.

Included will be a general test area, various design and experimental areas, metal cutting and metallurgical research labs, a special humidity-controlled experimental area for textile machinery, a fully-equipped prototype shop, library, and offices.

Circular Tool Company Adds New Regional Representatives

Appointment of **Donald McIntire** and of Branch-Merwin Tool Specialists as representatives is announced by Circular Tool Co., Inc., Providence, R.I.

Mr. McIntire, who has built up extensive experience in the sale of small tools over the past twelve years, will be in charge of Circular Tool Company sales distribution in the state of Indiana. His activities will be based at 5129 West 12th St., Speedway 24, Ind.

Branch-Merwin Tool Specialists will represent Circular Tool Co. in the four-state area of Tennessee, Alabama, Mississippi and Arkansas. **W. B. Branch** and **C. W. Merwin**, principals of Branch-Merwin, bring to the new association a combined experience totaling 19 years selling tooling and allied lines in their territory. Their headquarters is 477 North Bellevue, Memphis 5, Tenn.

Oliver Instrument Fetes Robert Sack's 40 Yrs. Service

Robert J. Sack, secretary and treasurer of the Oliver Instrument Co., Adrian, Mich., was a guest of honor at a surprise party held by employees Sept. 23 to celebrate his 40 years of continuous service with the company. Sack has held virtually every job from office boy to secretary and treasurer as the company has grown.

Clark Elected President By Machine Tool Distributors

J. Russell Clark, president of White Star Machinery & Supply Co., Inc., Wichita, Kansas, has been elected president of the American Machine Tool Distributors' Association, it was announced at the Association's 35th Annual Meeting in St. Louis October 26, 1959. Clark has been the Association's vice president during the past year.

Cushman Chuck Co. Honors Harry Sloan's 60 Yrs. Service

Friday, October 2, marked 60 years continuous service for **H. Sloan** now Chairman of the Board, for The Cushman Chuck Co., Hartford, Conn.

At a dinner honoring the occasion, directors and officers of the firm presented Sloan with an engraved silver tray and commemorative album. His permanent employment began with the company as a workman in the factory at the age of 19.

READING BENCH KEYSEATER

Portable — move directly to job; a time saver for both small and large shops.

3¼" stroke; adaptable for other work.

Low first cost, prompt delivery.

Good dealers wanted

Reading Machine Co.

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Top Quality
Lowest Prices

Our Special Import...

DIAMOND WHEEL DRESSERS

Made of selected, full individual stones, mounted in 7/16" diameter x 6" long cold rolled shank.

Karat	Regular Price	Our New Price
¼	$ 6.00	$ 2.85
½	12.00	5.00
¾	21.00	7.50
1	30.00	10.25
1½	54.00	15.00
2	75.00	20.00
2½	102.00	26.00
3	130.00	32.00

These diamonds can be set in any shank to your specifications for $1.00 each extra.

Order today—Immediate Delivery From Stock!

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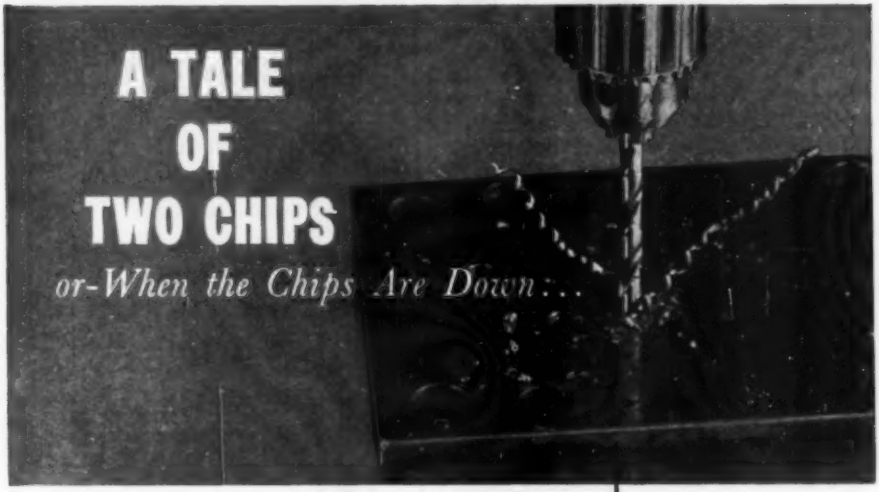
Cluff Retires as President of Frederic B. Stevens, Inc.

W. Joseph Cluff, a veteran of many years in the plating and foundry industries, closed a career of service as a supplier to these fields when he retired as president of Frederic B. Stevens, Inc. He will continue as consultant to Stevens and as a member of the Board of Directors of the Udylite Corp. Cluff started working for Stevens as a clerk in the bookkeeping department of an affiliated company. Twenty-five years ago he became president, succeeding Frederic B. Stevens, founder of the Detroit firm.



Do you get more holes per minute • longer drill life • closer tolerance holes • less operator fatigue?

Equal size chips mean you are getting these results from your drills.

Hand sharpened drills should produce equal size chips . . . but only after time-consuming work by an expert. Now, with the Black Diamond Drill Grinder*, anyone in your plant can do the job with repeat accuracy in just a few seconds. Get the facts by return mail. Write exclusive distributor:

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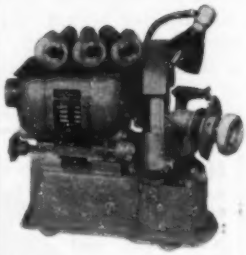

BLACK DIAMOND DRILL GRINDERS:
For #70 drills up to ¾ (Illus.)

WORCESTER DRILL GRINDERS:
For ⅛" drills up to 2½"

*Black Diamond Saw & Machine Works, Inc.
Natick, Mass.–Manufacturers of Black Diamond and Worcester Drill Grinders.

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Appointments and Promotions

Personnel Changes . . . Executive and Production

R. P. Villwock

Dr. D. Evers

A. S. Chivers

W. deVore

Richard P. Villwock has been appointed research engineer of Michigan Abrasive Co., Detroit . . . The Hanson-Whitney Co., Hartford, Conn., announces the election of **Brenniss G. Tyrrell** as executive vice president and **Oliver B. Ellsworth** as chairman of the Board of Directors . . . **Robert N. Kolb** has been named labor relations manager of Latrobe Steel Co., Latrobe, Pa. . . **Louis Polk, Jr.,** has been named assistant vice president and manager of the gaging and automation systems divisions, including the service and repair depots located in major industrial areas, for the Sheffield Corp., a subsidiary of the Bendix Aviation Corp., Dayton, Ohio. . . . **Dr. Dillon Evers** has been appointed to the Management Committee of Sharon Steel Corp. as consulting metallurgical engineer. **Eric G. Messler,** formerly vice president of Sandvik Steel, Inc., Fair Lawn, N.J., has been elected president and general manager of Sandvik Canadian Ltd., with headquarters in Montreal . . . Promoted to the newly-created post of manager of the Watertown (Mass.) Division of Barry Controls, Inc., is **A. S. Chivers. Russell T. Lowe,** chief engineer at the Watertown plant, is promoted to Chivers' former position of manager of the Western Division at Burbank, Calif. . . . . **Frank Colbourn** has been named as general manager of Rotex Punch Co., Inc., San Leandro, Calif. . . . Taylor Fibre Co. has organized an Advanced Materials Division to develop laminated plastics and vulcanized fibre for rockets, missiles, etc. and has named **Weber deVore** as director of the new division . . . **Barry S. Weissman** has been named controller for The Producto Machine Co., Bridgeport, Conn. . . . **Keith A. Hill** has been appointed chief engineer of New Product Development for the Besly-Welles Corp., South Beloit, Ill. . . . **Woodrow Tichy** has been elected a vice president of United-Greenfield Corp. In addition, he will continue as general manager of the Whitman

B. G. Tyrrell

E. G. Messler

F. Colbourn

B. S. Weissman

& Barnes Division at Plymouth, Mich. . . . **James S. Laidlaw,** vice president-engineering of Hycon Mfg. Co., Pasadena, Calif., has been elected vice president and general manager to succeed **William T. Snebold** who resigned. Snebold will continue to serve on Hycon's Board of Directors. **Edmund W. Baker** will take over Laidlaw's former position . . . **John A. Succop,** vice president in charge of metallurgy for Heppenstall Co., Pittsburgh, has retired after 39 years' service with the company. He will continue to serve the firm in a consulting capacity. . . . Firth Sterling Inc., Pittsburgh, announces the election of **Champ Carry** and **Carl A. Ilgenfritz** to the board of directors. Carry is president of Pullman Inc., Chicago, and Ilgenfritz is a director of Foundation Co., New York City, and prior to his retirement, a vice president of U.S. Steel.

Personnel Changes . . . Sales and Service

E. H. Holm

H. T. Pierpont

E. Henry Holm has been named manager of marketing research by Latrobe Steel Co., Latrobe, Pa. . . Norton Co. of Worcester, Mass., has made a number of appointments recently which includes **Robert Cushman** being appointed general sales manager of the Abrasive Division. **W. Alex McCune** succeeds him as sales manager of grinding wheels. **Harlan T. Pierpont** has been named sales manager of abrasives, succeeding **George A. Park** who retired Oct. 1 after 50 years with Norton. **William A. Russell** returns to the Worcester, Mass. office to assume McCune's former post as manager of field sales, grinding wheels. **David H. Paul** has been named district manager at Detroit . . . **James K. McGinley** has been appointed general sales manager of Durant Manufacturing Co., Milwaukee, Wis. . . . **Andrew J. Kirchner** has been announced as the new manager of Export Sales for Ex-Cello-O Corp., Detroit. He succeeds **Stewart J. Elliott.**

R. Cushman

J. K. McGinley

You Need an Extra Hand Now
to Speed Up Production!
HEIMANN TRANSFER SCREW SETS
Here is the faster, more precise way of transferring open and blind screw holes—make savings in "wage-dollars-per hour" of your expensive hands on every job. A die-and-tool maker's tool with many other applications for die makers and machinists. A set of 6 Hardened Screws nested in combination holder and wrench—no other tools needed. Get more work now—save money too!
IN 11 SIZES—No. 6 to 1" N.C. In all S.A.E. sizes.
HEIMANN MFG., CO. ● URBANA, OHIO

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who retired Sept. 30 . . . **Richard E. Salisbury** has been named manager-merchant bar sales for the Calumet Steel Division of Borg-Warner Corp., Chicago . . . Universal-Cyclops Steel Corp., Bridgeville, Pa. has appointed **Jesse E. Shackleton** as sales representative in the western sales district, with office at 7046 Hollywood Blvd., Los Angeles . . . **Gorden Gentzler** has been named as sales representative in Ohio and Pennsylvania of the Electric Kansas City, Mo., and Amarillo, Houston, Dallas, and Ft. Worth, Texas. His location is at 10812 Woodland, N.E., Albuquerque, N. Mex. . . **George J. Probost** has been appointed to the sales engineering staff of Rolle Mfg. Co., Lansdale, Pa. . . . Huck Mfg. Co. of Detroit has named **Fred J. Coelen** and **Richard D. McChesney** as engineering representatives in the lower three-fourths of Texas, under **W. D. Messer,** Midwest Sales Division Manager.

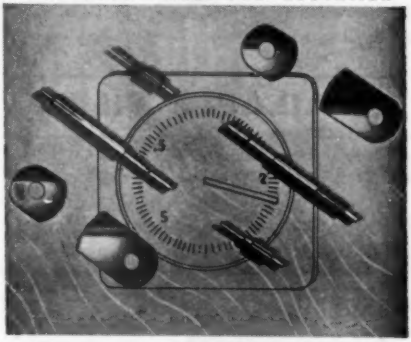
J. P. Baxter

G. O. Corbett

Products Division of McQuay-Norris Mfg. Co., St. Louis, Mo. . . . Cooper Alloy Corp., Hillside, N.J., has appointed **Harold G. Haucke** to the position of sales engineer, Foundry Products Division . . . **John P. Baxter** has been named sales representative in the Connecticut area by the American Emery Wheel Works, Providence, R.I. He will be associated with **Charles A. Hanlon** in the Bridgeport office . . . **Glen O. Corbett** has been announced as Southwestern field service manager for the Industrial Controls Section, Bendix Aviation Corp. of Detroit. His territory is Albuquerque, N. Mex., Boulder, Colo.,

20 TO 200 D.P.

SEND YOUR PRINTS FOR QUOTATION



SPURS • HELICALS • WORM AND WORM GEARS
STRAIGHT BEVELS • LEAD SCREWS • RATCHETS
CLUSTER GEARS • RACKS • INTERNALS • ODD SHAPES

THE Finest IN GEARS

Beaver Gear Works Inc

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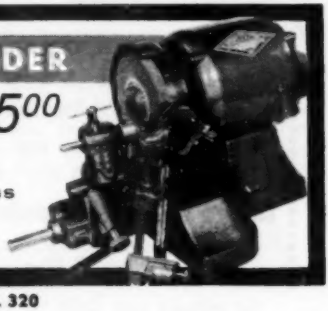
Lisle DG-3 DRILL GRINDER

Complete, nothing else to buy .. only $175.00

Easy to operate. Patented feed system assures correct heel clearance, chisel or web angle, and cutting lip angle. Sharpens all 1/8" to 1-1/4" drills, with no extra attachments! Write for full details.

LISLE CORPORATION • Clarinda, Iowa



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New Dealers and Distributors

Company	Address	Distributor for
Kerns-Merrell Co.	9140 Charlevoix Ave. Detroit, Mich.	Rivett Inc. Boston, Mass.
Mahar Tool Supply Co., Inc.	1708 N. Michigan Ave. Saginaw, Mich.	Latrobe Steel Steel Co. Latrobe, Pa.
Flask-Pennell Co.	329 S. Baum Ave. Saginaw, Mich.	Wesson Co. Ferndale, Mich.
National Welding Supply Co., Inc.	Charlotte, N.C.	American Platinum Silver Div. Engelhard Industries, Inc. Newark, N.J.
Beesley-Hoffman Machinery Co.	Buffalo, N.Y.	Pressure Blast Mfg. Co., Inc. Manchester, Conn.
H. E. Hofferberth Machinery Co.	Dayton, Ohio	Pressure Blast Mfg. Co., Inc. Manchester, Conn.
Riordan Machinery Co.	Detroit, Mich.	Pressure Blast Mfg. Co., Inc. Manchester, Conn.
Stanley Supply Co.	Cleveland, Ohio	Pressure Blast Mfg. Co., Inc. Manchester, Conn.
Lee Hornmeyer Co.	St. Louis, Mo.	Pressure Blast Mfg. Co., Inc. Manchester, Conn.
Industrial Sales Service, Inc.	Dallas, Texas	Pressure Blast Mfg. Co., Inc. Manchester, Conn.

AVAILABLE FILMS

Allegheny Ludlum Offers Film Distribution Service

Allegheny Ludlum Steel Corp. of Pittsburgh has a film library which provides more than twenty films, all in 16mm color prints, with sound. They cover interesting aspects of production, fabrication and end-use of Allegheny Ludlum products—stainless, tool and electrical steels, and Carmet cemented carbides. For instance, "The Shining Heart," a 32-minute film with a Hollywood cast starring Donald Woods, highlights stainless and other special steels as the heart of many vital uses, some never before recorded on film.

The motion picture list is obtained from the Allegheny Ludlum Steel Corp., Oliver Bldg., Pittsburgh 22, Pa.

131

the latest completely illustrated **free** CATALOG No. 207

A complete line of vises and rotary tables for production, tooling and maintenance.

68 different models and types. Vise jaw sizes from 1½" to 8".

Chicago Tool and Engineering Co.

8384 South Chicago Ave.
Chicago 17, Ill.

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BOOK REVIEWS

KAISER-ALUMINUM FORGINGS—PRODUCT INFORMATION. Available from Kaiser Aluminum & Chemical Sales, Inc., 1924 Broadway, Oakland 12, Calif. 336 pages. $7.50

Advantages of using aluminum forgings in all types of metal fabrication are presented in detail in this new book just released to industry. Various types of forging processes are outlined. More than 200 illustrations are included and numerous resultant forged aluminum products are shown. Through the use

of this book, design and production engineers are able to determine the type of forgings applicable to specific products or assemblies.

Information is presented on forging tolerances as they affect aluminum forging design, which enables forging users to select their needs for specific parts.

No charge is required when book is requested on company letterhead.

MACHINERY'S HANDBOOK. Published by The Industrial Press, 93 Worth St., New York 13. 16th Edition, 2104 pages, 4½" x 7". ***$11.00.***

This latest edition reflects the rapid growth and accumulation of data in the mechanical industries, the large number of new American and British Standards, the changes in engineering and manufacturing practice, and the advances in new materials and alloys. The handbook still remains a compact 4½" x 7".

The section on screw thread systems has been completely revised to reflect the latest changes in screw thread standards. New designations, applicable to ground thread taps, have been added. Complete sections are given over to consideration of plain bearings, as well as all types of ball, roller and needle bearings. Tables of horsepower ratings and other data for various standard size drives provide for the increased use of double-enveloping type worm drives in machines and machine tool applications.

Numerous new or revised subjects include gearing, springs, use of involute splines and serrations, heat-treated steels, self-tapping screws, etc., etc.

Melard Products, Inc. 2926 White Plains Rd. N.Y. 67, N.Y.

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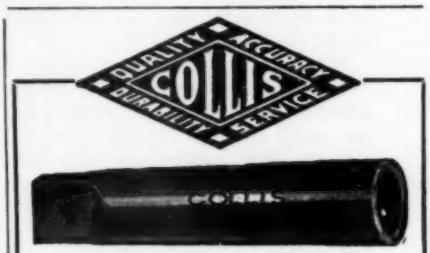

STANDARD TYPES

SLEEVES AND SOCKETS

Now!

HEAT TREATED . . .

So popular with users.

COLLIS Heat Treated Sleeves and Sockets are manufactured by skilled workmen to give long durable service and extra long life. This type of sleeve has less chance of nicks and assures same accuracy with longer runs.

Call at once for our representative to explain about the Complete Collis Line of Lathe centers, Arbors, Drill Drifts, and Magic Type Chucks as well as Sleeves and Sockets and Collets.

"Call Collis for Service"

THE COLLIS CO.

DEPT. A, CLINTON, IOWA

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PUSH BUTTON *Speed Selection*

from to in seconds

or to *any* intermediate speed, *instantly*

Just push a button and watch the large tachometer dial on the headstock!

It's that easy!

The work is done by a motor driven speed changer. It accelerates or slows the lathe to any desired speed in seconds. With a 10:1 ratio, this new variable drive makes it easy to select from a wide range of speeds—200 to 2000 rpm in direct drive and 40 to 300 rpm in back gear.

Maximum stability and smooth power transmission are assured because the drive unit is oversized. All pulleys and shafts are fully supported (eight bearings). Double V-belts throughout the drive eliminate slippage and deliver full power to the spindle. Because of this rigidity and extra pulling power, this lathe will take heavy cuts at all speeds and precision finish cuts at high speeds.

It is a precision lathe, moderate in price, with the versatility for toolroom, production or second operation jobs.

SHELDON *Variable Speed* PRECISION LATHES

Illustrated
WM56P
13" Swing- 34" Centers
Base Price F.O.B. Factory
$2146.00
Less Chip Pan and Electricals
Also available with 11" Swing

Write for

"Variable Speed" Circular and General Catalog showing . . .

•

10", 11", 13" and 15" SHELDON Precision Lathes (Bench, Pedestal and Cabinet types)

•

13" and 15" SEBASTIAN Geared Head Lathes

•

SHELDON Milling Machines

•

SHELDON Back Geared Shapers

SHELDON MACHINE CO., INC.
4242 N. Knox Ave. • Chicago 41, Ill.

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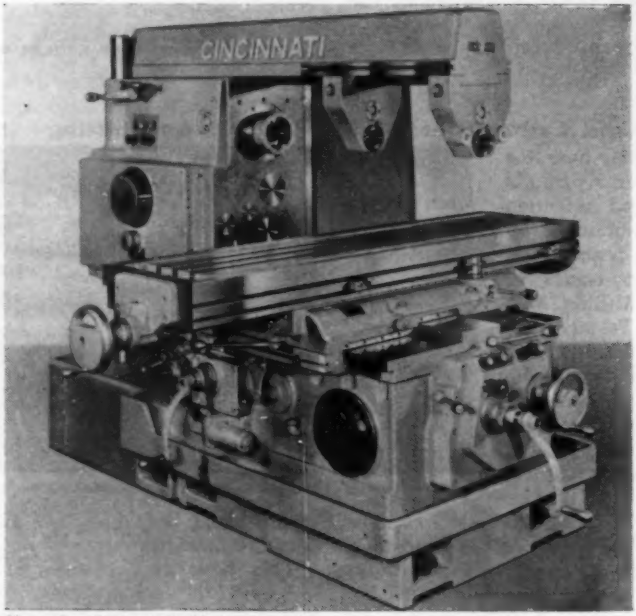


Knee is eliminated. Vertical motion is transferred to spindle carrier.

MILLING MACHINE COMBINES BED, KNEE AND COLUMN, RISE AND FALL TYPES

Rigidity of a bed-type, convenience of knee and column type and capacity of a rise-and-fall type join forces in Cincinnati's latest fixed knee milling machine. Its design eliminates the knee and transfers vertical motion to the spindle carrier. Saddle and table are mounted directly on the machine bed. The broad based square gibbed ways suit the machine to heavy cuts, climb as well as conventional milling, and large, weighty workpieces. The machine handles reciprocating, box milling, and climb cuts with ease. An automatic backlash eliminator works to prevent chatter and assure smooth cuts.

Feed rates (32 in geometric progression) and speed rates (24 in geometric progression) can be read at a glance on large dials near the operating stations. All drive motors and a full cutting fluid system are standard equipment with the machine.

The table can be cycled manually or automatically.

Two full sets of controls are provided—a front set and a similar set on the side of the base behind the saddle. This helps the operator if view of the cutting action is blocked by the workpiece.

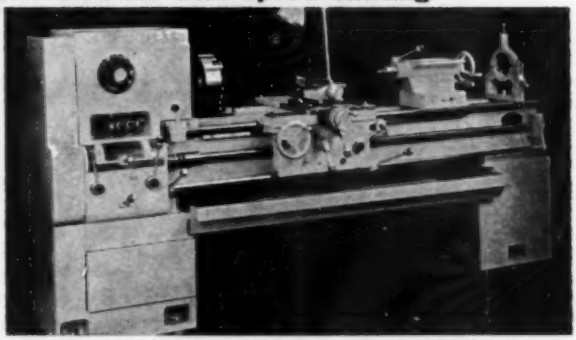
Four models are offered ranging from 20 to 30 hp, with 72" to 80" table travel, 12" saddle travel and 20" vertical travel. Options and accessories are the same as those offered for the Dual Power line.

Cincinnati Milling Machine Co., Cincinnati, Ohio.

Use postpaid card. Circle No. 80

Geared Head Lathe Offers Power Dial Speed Shifting

A completely new line of lathes with hydraulic spindle speed selection has been announced by Cincinnati Lathe and Tool Co., associate of Cincinnati Milling Machine Co. Termed the Hydrashift, the lathes are claimed to be the first geared head lathes in the economy-priced class with this power dial speed shift feature. To change spindle speeds, the operator has only to rotate the dial on the front of the headstock to the desired rpm, and hydraulic power does the shifting automatically. There is a selection of 12 spindle speeds. The quick-change feed selection mechanism provides 48 threads and feeds.

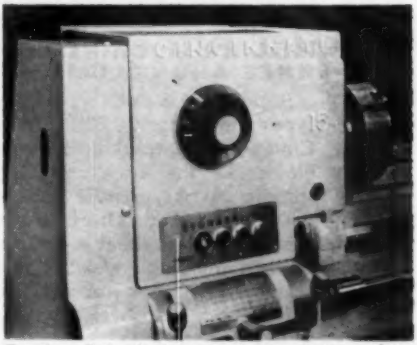


Wider, heavier compound and cross slide handle heavy cuts.

A new super high speed range is offered with a top speed of 3,000 rpm, which provides surface speeds capable of handling the latest tooling developments such as carbides and ceramics.

The new quick clamp tailstock is secured in position by a single lever, allowing very rapid tailstock positioning. New productivity is also reported possible with the wider, heavier compound and cross slide to handle heavy, high speed cuts. Other operator conveniences are large, easy reading dials for slide adjustments, and new coded pushbutton controls. Along with higher horsepower drives afforded, greater rigidity and long life have been built into the machines.

This new line includes 10", 12½", 15" and 18" swing sizes in a wide variety of bed lengths, and raised models for the 18" machine.



Turning dial selects any of 12 spindle speeds.

Cincinnati Lathe and Tool Co.

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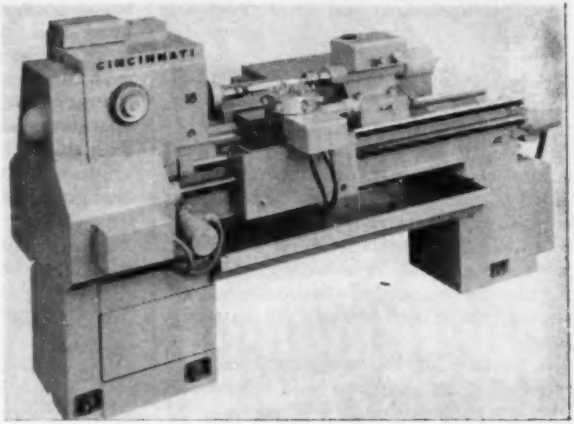
Economical Numerically Controlled Lathes & Drilling Machines

The new Cincinnati numerically controlled lathes and Cincinnati drilling machines with numerically controlled positioning tables are designed to provide the "speed, accuracy and managerial advantages of the numerically controlled tool, with a price tag that is within the reach of every manufacturer," stated Griffith C. Taaffe, president of Cincinnati Lathe and Tool, associate of the Cincinnati Milling Machine Co.



Cincinnati Lathe and Tool's new numerically controlled lathe.

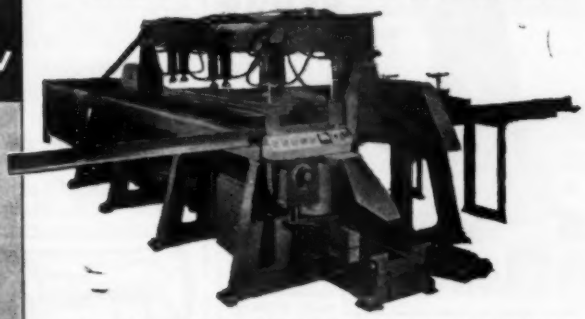
All functions are controlled electronically or hydraulically from a program tape, located in the control cabinets. There are no manual controls. Recognizing that the vast majority of lathe work falls within the step turning category, the lathe employs a point-to-point positioning control specifically designed for this type of job. Coupled with its six position tool turret, necks,

"OLIVER"
NO. 838
PLATE SAW

HEAVY DUTY
PRODUCTION
SAW

for precision cutting of plates and sheets of all sizes up to 6" thick

NOW, good clean cuts within tolerance for nonferrous metals



For cutting aluminum, bronze, micarta, copper and other nonferrous metals . . . adaptable to individual requirements, yet provides economy of operation . . . satisfies rigid demand for accurate work and fast cutting. Send for illustrated folder giving full details.

OLIVER MACHINERY COMPANY
GRAND RAPIDS 2, MICHIGAN

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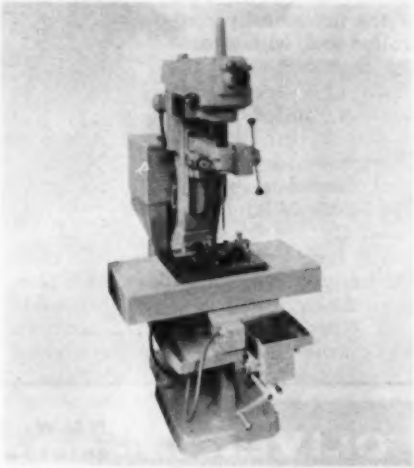
chamfers and varying diameters may be cut both toward and away from the headstock in a completely automatic cycle.

Selection of feeds and speeds, selection of tool sequence, positioning of the tools, length and depth of cut are all typed into the tape and performed automatically. Only operator attention required is to load and unload the workpiece, insert the program tape in the tape reader, then start the cycle from the cabinet. A minimum number of tools are needed to machine an almost unlimited variety of turning jobs.

A feature of the Acramatic control reported is its ability to hold tolerances with great precision.

In applying numerical control to drilling, an Acramatic unit is designed into a work-positioning table mounted on a Cincinnati sliding head drilling machine. The basic components consist of a numerical control console with tape reader, a rugged table unit, pneumatic pack and Cincinnati's 24" sliding head drill. Accurate positioning of the work to the spindle is performed automatically by the positioning table to tolerances of .002", it is reported. The operator can then spend his full time on drilling.

Other features include the speed change which is extremely quick with the Infispeed variable speed drive. Geared power feed with automatic depth stop and kickout is said to provide precise depth control to .005" accuracies.



Cincinnati Lathe and Tool's 24" sliding head drill equipped with numerically controlled positioning table.

Cincinnati Lathe and Tool Co.

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NEW WAY OF STAMPING HEX PLUGS or around circumference of SLEEVES

As handle is turned, gear arrangement moves roller die across part being marked. Fixture uses cradle for sleeves and special table for hexes. Write for Bulletin 646.

Mecco SAFETY G·R·D STYLE B MARKING FIXTURE

A product of the Marking Device Industry

M. E. CUNNINGHAM CO.

1048 CHATEAU STREET, PITTSBURGH 33, PA.

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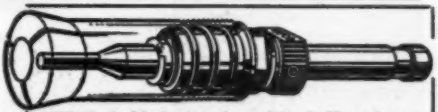

NEW! Self-Centering 5C Collet Stop

Quick friction adjustment Stays in fixed position. Will not distort collet. Will not move back. Also available for other collets and spindles. 30 Days Free Trial. Several Territories Open for Distributors.

Write for Bulletin.

BYCO INDUSTRIES

2201 Snelling Ave. Minneapolis 4, Minn.

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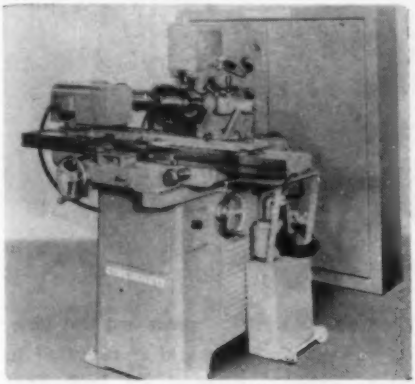
Grinder Sharpens Cutters As Milling Machine Operates

The simplicity and automatic features of the new automatic cutter grinder enable the operator to sharpen his own cutters while maintaining production on a milling machine. Once the grinder is set up, it will sharpen identical cutters without operator attention. Either right- or left-hand plain or stagger-tooth cutters can be ground.

Featured is automatic wheel truing. The operator need only decide how



Offers completely automatic cycle, wheel truing.

many teeth he wishes to grind between truings and how many passes of the diamond will be required. He sets these numbers on the control. At the pre-set intervals, the diamond advances .001" per pass and makes as many passes as have been programmed. Saddle pick-feeds .001" to compensate. The saddle can be dial-set to pickfeed between .00025" and .005" in increments of .00025".

To assure concentricity, the grinder is equipped with a counter to permit 180° rotation of cutter after the first rough grind revolution. By this method the effects of tool wear are minimized. Eight counters on the machine panel permit quick selection of the desired cycle.

Cincinnati Milling Machine Co.

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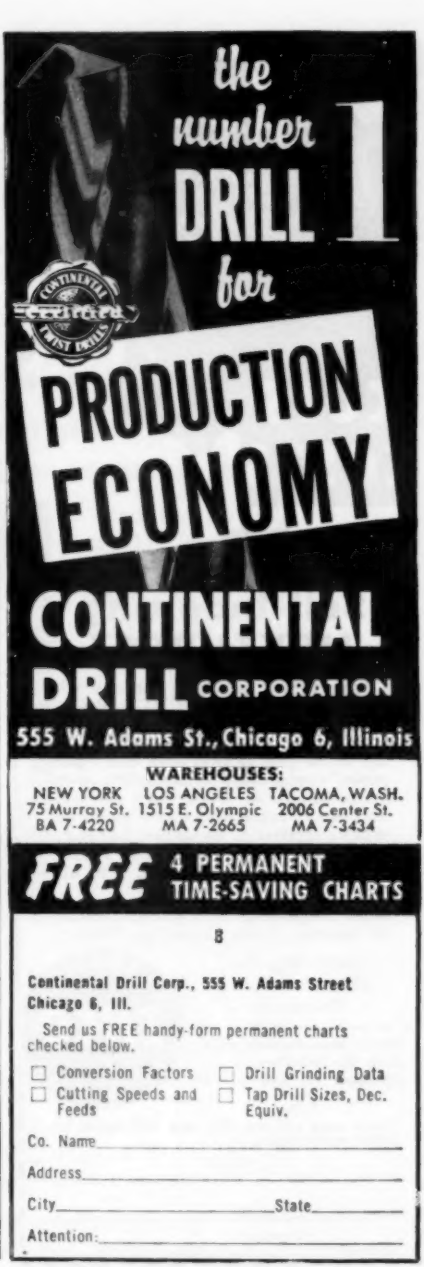

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ENCO

Self-Indexing HEXTURRET

Convert your lathes for turret work this quick, easy way. ENCO HEXTURRET gives you the *accuracy*, *rigidity* and *speed* you need to step up lathe production and cut "per piece" costs. Easy as mounting your lathe tailstock. Does both normal and heavy lathe and screw machine work, drilling, counter boring, counter sinking, spot facing, reaming, turning, boring, etc. Fit all lathes 9" to 16" swing.

Mail coupon for cat. #53 and name of nearest Enco Franchise Dealer.

ENCO Mfg. Co.
4520 W. Fullerton
Chicago 39

PRECISION ENCO ECONOMY

ENCO Manufacturing Co,
4520 W. Fullerton,
Chicago 39, Dept. 2129

Please send catalog #53 and full details of ENCO HEXTURRETS.

Name_____

Firm_____

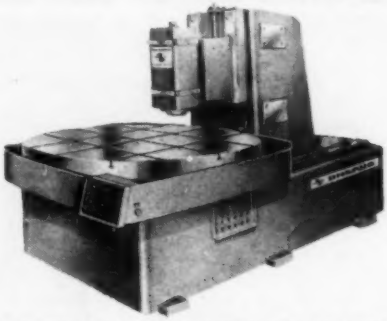
Address_____

Use postpaid card. Circle No. 329

Miller Has Rigidity Plus Speed For Nonferrous Face Milling

The Onsrud MM-48 Mach-Mil for non-ferrous face milling and supplied with attachments for secondary operations is said to combine high milling speeds and fast rotary table feeds with a rigidity in over-all construction equal to that of the finest bed type machine.

The basic machine is designed with a single vertical head for face milling. A second milling head may be supplied



Combines high milling speeds and fast feeds.

as extra equipment and is reported to make possible in a single pass such double operations as roughing and finishing, face milling and profiling or milling at two elevations.

Besides the advantages of the rotary feed table, the machine is equipped with a specially designed Onsrud direct drive high speed motorized milling head which provides ample speed and power for milling non-ferrous metals, particularly the aluminum alloys.

Work surface diameter of the table is 48". The face milling head is adjustable vertically in a range from 2" to 15", measured from table surface to spindle nose. There is a radial adjustment of 12" to 28". One of many milling heads available is a 10 hp, 3,600 rpm motorized spindle unit. High speed table drives are available in a choice of two speed ranges.

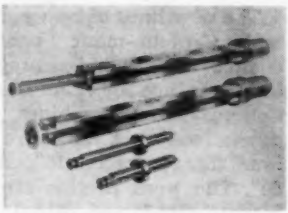
Onsrud Machine Works, Inc., Niles, Illinois.

Use postpaid card. Circle No. 85

14' Long Spindle Permits Heavy Cuts

Pope Machinery Corp. believes the spindle shown is the longest ever built—14' long. It is a precision, heavy duty boring mill ram equipped with a Pope precision two-speed motor and with interchangeable extension spindles. This deep hole spindle is claimed to be exceptionally rigid, with shaft and bearings of excess capacity, permitting heavy cuts and assuring good finish ground holes and long wheel life. It is also reported all rotating parts are dynamically balanced in full assembly for smooth running.

Pope Machinery Corp., Haverhill, Mass.



Exceptional rigidity provided.

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DUSTKOP "520"

designed to collect dust from single machines

portable—easily installed

DUSTKOP STOPS DUST

Self-contained Dustkop models, like the "520," are practical and effective in collecting dust from single machines. They're designed specifically for service with surface grinders, tool and cutter grinders, offhand grinders, buffers and other small wheel equipment. These units are also easy to install — are actually portable — and very economical to operate.

Write for illustrated literature

46 models to choose from!

NEW DUSTKOP AUTO SHAKER shakes filters AUTOMATICALLY

AGET manufacturing company

1402 E. Church Street, Adrian, Michigan

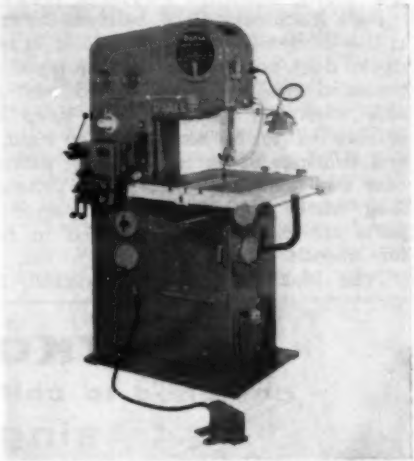
ask for details

Use postpaid card. Circle No. 330

Complete Redesign of DoAll Band Machines

The new lines of heavy-duty Contour and Contour-matic band machines complete the redesign program started one year ago by The DoAll Co. The Contour-matic machines, featuring power feed work table, are available in four throat depths 16", 26", 36" and 60". The work heights are 13" for the Models 2613-3 and 6013-3, and 12" for Models 1612-3 and 3612-3, a substantial increase over previous models.

The 16" and 36" machines are intended for toolroom and manufacturing, while the 26" and 60" machines are intended for heavier duty service. The machines are engineered to give maximum strength and rigidity possible, with 1/3 deeper sections in the columns and heads of frames for the 16" throat machines. Added strength affords the proper band tension needed for obtaining maximum advantages from the Demon saw band.



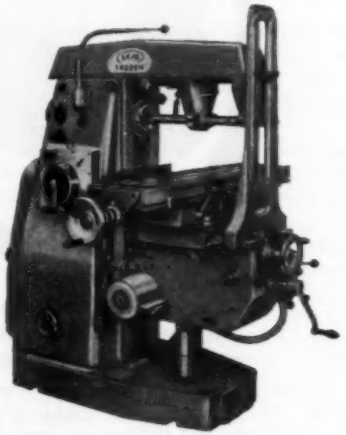
Model 1612-3 Contour-matic band machine.

The new dial type band tension indicators are said to give the proper tension for any width of any type sawing, filing or polishing band within the machine capacity. This includes

PAINSTAKING ATTENTION TO DETAIL
characterizes SAJO Millers

exemplified by the unsurpassed SAJO spindle construction employing double-row staggered roller bearings and ball thrust bearings — assures utmost stability and smooth transmission of full horsepower to cutter.

Available as
Plain, Universal & Vertical Millers.
Production Millers with automatic cycling.



No. 2 Universal Miller
table size: 52" x 11"
7½ and 1½ HP motors,
rapid power traverse.

austin industrial corporation

76-G Mamaroneck Avenue White Plains, New York

Use postpaid card. Circle No. 331

Demon high-speed steel saw band up to ½" wide and carbon steel band up to 1" wide.

All Contour-Matics use three-speed transmissions and infinitely variable drives. The 16" and 36" machines have 3 hp and provide 35 to 6,000 fpm band speeds; and the 26" and 60" machines have 7½ hp for their 45 to 9,000 fpm range.

The feed table is powered by a competely self-contained hydraulic system with convenient control for speed and direction.

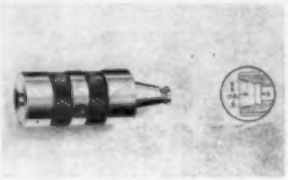
Along with this new line a companion line of heavy-duty Contour machines is available—the Models 1613-2, 2613-2, 3613-2 and 6013-2. These are similar to the Contourmatics except they do not have power-operated work tables and circulating coolant systems. They have the same throat sizes and rugged construction. Work height is 13".

The DoAll Co., Des Plaines, Ill.

Use postpaid card. Circle No. 87

Flush Pin Gage For Port Contours

Available is a standard flush pin gage for checking the "X" tolerance of MX-33514, MS 33515, NAS 1214 and NAS-1215 port contours. The gage is said



Checks the X tolerance.

to be simple, accurate and easy to use for in-process inspection as well as final inspection of port contours after machining. It is made of corrosion-resistant stainless steel and is available for all 13 sizes of each specification.

Sonnet Tool & Mfg. Co., Hawthorne, California.

Use postpaid card. Circle No. 88

26" Universal Shaper 7½ and 2 HP motors, rapid power traverse.

RUGGED DEPENDABILITY keynotes all VMA Shapers

for example:
Unique multi-piston oil pump assures automatic lubrication of all moving parts at pressure up to 400 p.s.i.
Built as
Plain and **Universal Shapers**
Production Model 18", 22" and 26"
Standard Model 14" to 28"
Also available —
Vertical Shapers
5" and 12" stroke

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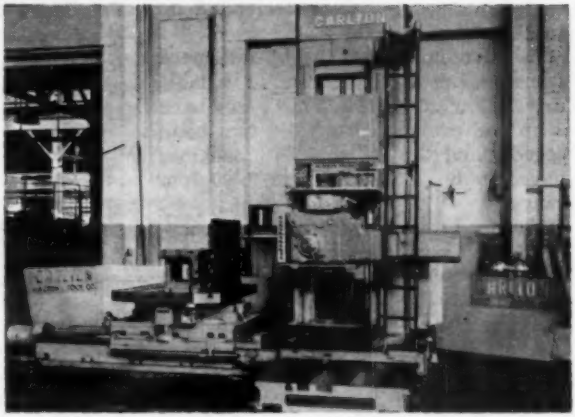
New Numerical Control For Carlton Machine Tools

The Carlton Machine Tool Co. of Cincinnati, in conjunction with Carlton Controls Corp., has combined horizontal and planer type boring and drilling machines with a new numerical control. The new combination is expected to speed up drilling operations, improve quality of work, eliminate the expense of jigs and elaborate tooling and make fuller use of drilling machine tools.

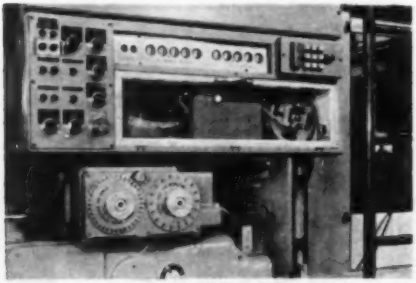


Horizontal and planer type boring and drilling machine with numerical control.

Three separate methods of programming control are provided.

(1) Tape control for automatic 3-axis positioning of tool, plus automatic speed-feed changes.

(2) Keyboard for separate, non-taped



Numerical control speeds up drilling operations, and makes fuller use of drilling machine tools.

operations provides manual input of 5- or 6-digit numerical data for each axis. Numerical values, actuated by keyboard or tape, are presented visually by indicator lights.

(3) Pushbuttons control rapid traverse and slow traverse power driven units, position the axis movements for manually operating the machine to establish different data points.

The Carlton Machine Tool Co., Cincinnati, Ohio.

Use postpaid card. Circle No. 89

New Coolant For Medium-Duty Cutting and Grinding

H-114 premium quality oil, an addition to Shear-Speed's line of high grade coolants and cutting oils, is said to provide greater production economies for medium-duty cutting and grinding. It has a sulphur chlorinated base with fatty E.P. characteristics to provide exceptionally fine finishes. The oil is also said to prevent wheel load-up, and helps wheels to stay free cutting, requiring less dressing.

Shear-Speed Chemical Products, Div. of Michigan Tool Co., Detroit, Mich.

Use postpaid card. Circle, No. 90

Niagara Modernizes Mechanical Sleeve Clutch OBI Presses

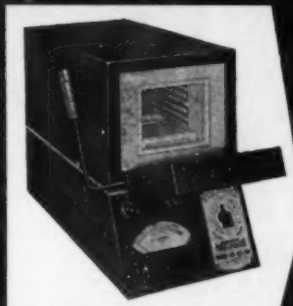
Long one of Niagara's largest selling OBI press lines, Series A Inclinables have recently undergone significant refinements. Continuing to feature Niagara's exclusive multi-point mechanical sleeve clutch, the line is described as ideal for continuous work requiring clutch engagement and disengagement at every press stroke.

Conspicuous in the design moderization is the slide, with its solid casting

Designed for Small Parts Treating . . . **HUPPERT**

DeLuxe

ELECTRIC FURNACES



• Here's a series of compact, durable furnaces that are ideal for tool and die shops and small laboratories. Any desired temperature within the range of 300° to 1900° F. is controlled by an accurate built-in Huppert Temperature Controller. All-steel construction — multi-insulation — sturdy Kanthal elements — counterweighted doors — removable porcelain tray.

Write today for literature on complete line of Huppert Furnaces and Ovens in floor and bench models. Ask for "Hints on Heat Treating."

Model No.	Inside Dimensions			Temp. Range	Watts 110 Volts AC	Price
	Wide	High	Deep			
434DL	4¼"	3½"	4½"	300°—1600° F.	920	$ 90.00
439DL	4¼"	3½"	9"	300°—1600° F.	1650	120.00
436DL	4½"	3¾"	6"	300°—1900° F.	1650	130.00
5DL	4½"	3¾"	9"	300°—1900° F.	1750	176.00
9DL	6"	6"	6"	300°—1900° F.	2200	200.00
669DL	6"	6"	9"	300°—1900° F.	3000	248.00
10DL	8"	4"	6"	300°—1900° F.	2000	220.00
849DL	8"	4"	9"	300°—1900° F.	3000	265.00

K. H. HUPPERT CO.

Manufacturers of Electric Furnaces and Ovens

6843 Cottage Grove Ave., Chicago 37, Illinois

Available for 220 Volt AC at small additional cost. Stainless steel housing slightly higher.

Use postpaid card. Circle No. 333

the **ARC-TWIN** *Cuts Two Perfect Notches*

in *One* Downstroke of Press!

SAVING both time and cost, it gives you perfect T-joints — instantly ready for welding or brazing without deformation or finishing! Twin-acting punch shears clean, from inside out, leaving two matching notches (in perfect 180° alignment) with every downstroke of the punch press. Quickly interchangeable dies and punches accommodate pipe and tubing from ½" to 2⅜" O.D.; special units, up to 3" O.D.

Special Arc-Twins for double notching stainless steel or monel metal and units built to your specifications can also be furnished.

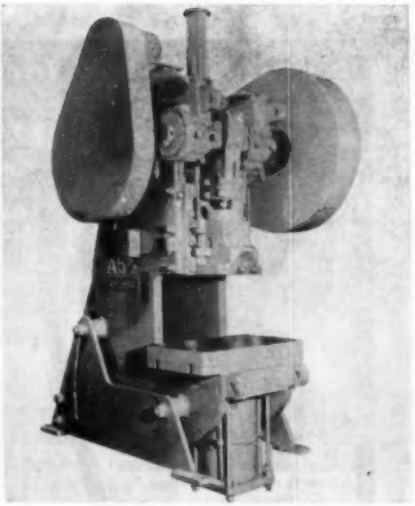
PATENTED

Ask for twin-notched sample of pipe or tubing

VOGEL TOOL AND DIE CORPORATION 1827 North 32nd Ave. Stone Park, Illinois

Use postpaid card. Circle No. 334

brought forward to provide solid backing for the dies. Flat surfaces on the front and sides simplify fitting feed roll lifters and other attachments. Rigid, multiple "V" gibs are said to assure accurate alignment, balanced loading and greater guiding surface. Additional refinements include an air power inclining device (optional), split belt guard (optional) to facilitate raising or lowering the slide, and quick adjusting friction clamp knockout rods.



Built in 13 standard sizes, from 5½ to 190 T.

Fewer parts and simple construction, according to Niagara, make this not only a more economical type of press to operate, but a much safer one as well. There are no complicated electrical circuits, relays, limit switches, solenoids, palm buttons, air valves or rotary air connections.

Built in 13 standard sizes with shaft diameters from 1¼" to 6½", the line covers a capacity range of 5½ to 190 tons.

Niagara Machine & Tool Works, Buffalo, N.Y.

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DANNEMAN *Precision* **DIE SETS**

Catalog on request

DANNEMAN DIE SET DIVISION
Acme-Danneman Company, Inc.
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70,000 R.P.M. TURBINE AIR GRINDER

GUARANTEED 12 FULL MONTHS

This high speed, light duty grinder is especially designed for tool and die makers. Perfect for grinding, deburring, cutting, polishing, engraving, intricate hand work.

$49.50 Complete with wooden case, 6 grinding wheels, 10' hose, spanner and dressing stone

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IMMEDIATE DELIVERY!

Cadmium plated, large selection of styles and sizes. Specials on request. Send for FREE catalog.

MACHINE PRODUCTS *Corporation*
6771 E. McNICHOLS ROAD • DETROIT 12, MICHIGAN

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New Heavy-Duty Multiple Spindle Drill Head

Cleveland Pneumatic Industries has added the Model 98-X heavy-duty multiple spindle drill head to its series of drill heads. Designated as "Hercules," it offers a drilling capacity greater than the Model 98. Nine driving stubs (one is a center stub) are provided, with max. capacity of nine 5/8" drills in mild steel. Featured is a steel reinforcing band to prevent damage to hood during installation. Head has a 1:1 gear ratio and is recommended for speeds to 2500 rpm. Various accessories are available.

Cleveland Pneumatic Ind., Inc., Skokie, Ill.

Use postpaid card. Circle No. 92

Cap.—nine 5/8" drills in mild steel.

...offers you SAFETY and economy of feeding and ejection

PRES-VAC SAFETY FEEDERS feed blanks to press from a safe distance of 14 inches—BY AIR!—maximum protection to operators and handling costs kept at a minimum.

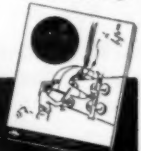
Save those fingers. $35.00

AIR BLAST VALVES eject parts safely with each stroke of the press—BY AIR!

Save those hands. $29.00

4583

Write for NEW Catalog!



VAC-U-MATION DIVISION

4147 Ravenswood Avenue, Chicago 13, Ill.

District Offices: Detroit and Cleveland

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GENERAL PURPOSE HEAT TREATING FURNACE

The Lucifer 7055 Series was designed for hardening, annealing, drawing, preheating and special applications. Produced in 13 standard models with heat ranges of 2,000°F. and 2,300°F., the 7055 Series operates on standard line voltage. No transformer is necessary. All models include . . . automatic controls, thermocouple, lead wire, magnetic contactor, horizontal swing door or vertical lift door, positive seal cam lock, cast hearth plate, long-life elements (low watt density), and our exclusive one piece monolithic holders that permit rapid element replacement at a minimum of downtime.

For a free brochure or engineering advice, write, wire or call . . .

LUCIFER FURNACES, INC.
Neshaminy 1, Pennsylvania
Diamond 3-0411

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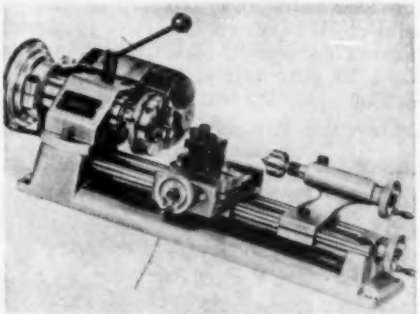
Miniature Machine Shop Affords Tolerances Down to .004"

Simple to operate, the Unimat basic unit can be set up as a lathe, drill press, milling machine, tool grinder, polisher and hand drill. This unit, the



"Give this ingenious machine tool just 16" and you've got it made," claims American Edelstaal.

size of a typewriter, is a boon in tooling small parts, the manufacturer reports, as there is no need to waste big, expensive-to-run machinery. It is valuable in the mock-up shop to manufacturers developing new products. Engineers and designers can supplement their sketches and blueprints with machined-to-scale models anybody can "read."

Machine work turned out is claimed to have tolerances down to .004 of an inch.

The basic unit also comes complete with motor, lathe, drill chuck and other lathe accessories.

American Edelstaal, New York, N.Y.

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Make 3 hammers AT ONCE!

It's the NEW, easy, economical, quick way to mold your own lead hammers on a production basis with "SHUR-GRIP" handles and this COOK production mold.

Write for circular and prices

COMPLETE LEAD HAMMER SERVICE

COOK'S LEAD HAMMER SERVICE
67 Massasoit Avenue, East Providence 14, R.I.

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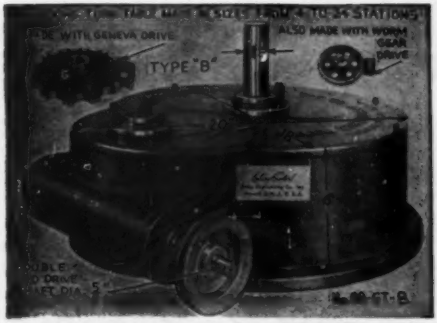
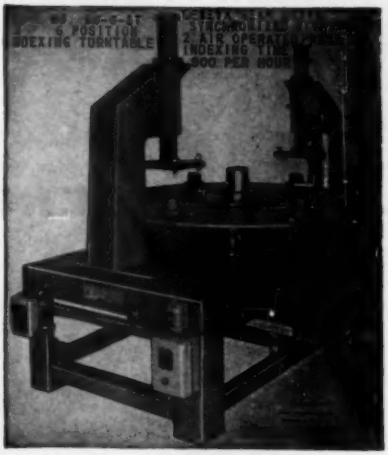
EISLER MAKES OVER 300 DIFFERENT TYPES OF INDEXING TURNTABLES. SPECIAL MADE TO YOUR SPECS. WRITE FOR CATALOG.





Dr. Charles Eisler Me. Founder **Charles Eisler, Jr. Pres.**

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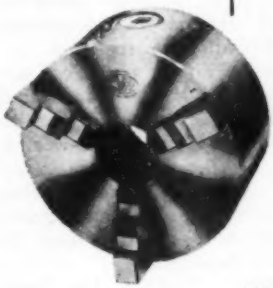
CVA LATHE CHUCKS

ONE OF ENGLAND'S FINEST . . .



3 JAW GEARED UNIVERSAL SCROLL

with average guaranteed accuracy of .002" three inches from the jaw face

AND OTHER GREAT FEATURES INCLUDING: ONE PIECE BODY • FLAME HARDENED JAW WAYS • INDUCTION HARDENED SCROLL FORM • SUPPLIED COMPLETE WITH TWO SETS OF JAWS AND CHUCK WRENCH

Size	Weight	Dia. of Bore	Price*
3½"	6 lbs.	5/8"	$34.00
4½"	6 lbs.	1-1/8"	34.00
5½"	11 lbs.	1-1/2"	40.00
6½"	16 lbs.	1-11/16"	46.50
7½"	26 lbs.	2-1/4"	55.00
9"	38 lbs.	2-3/4"	70.00
10½"	68 lbs.	3-1/2"	86.00
12"	106 lbs.	3-7/8"	115.00

*Prices f.o.b. warehouse, N. Y. C.
Back plates available at extra cost.

Superior chucks produced by an English manufacturer famous for precision built machine tools, representing unbeatable values. Certificate supplied with every chuck attesting to and guaranteeing accuracy. All parts guaranteed for a year against defective workmanship and materials. Repair parts available.

We also stock 4 JAW INDEPENDENT LATHE CHUCKS

AND FOR BOTH 3 AND 4 JAW CHUCKS

- Direct mounting for American long taper spindle nose.
- Direct mounting camlock fitting.

ALL IN STOCK FOR IMMEDIATE DELIVERY!

Write us for complete new lathe chuck catalog

MANHATTAN SUPPLY CO., 151-A GRAND STREET, NEW YORK 13 • CANAL 6-4992

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HIGHER SPEEDS!
FASTER GRINDING!

kipp

AIR GRINDERS

MODEL JA
50,000 R.P.M.
$60.00
IN U.S.A.

Weight 12 ounces; length 6¼ inches; chuck size ⅛ inch. Wheel guard removed for better illustration.

THE SPEED of Kipp Featherweight Air Cylinders stays up where it belongs, under load, for efficient grinding even with small wheels. This may not be true with most of the "Plug-In" grinders you now are using.

HAVE YOU GIVEN your toolmakers a chance to save valuable hours by providing them with enough Kipp Featherweight Air Grinders and accessories?

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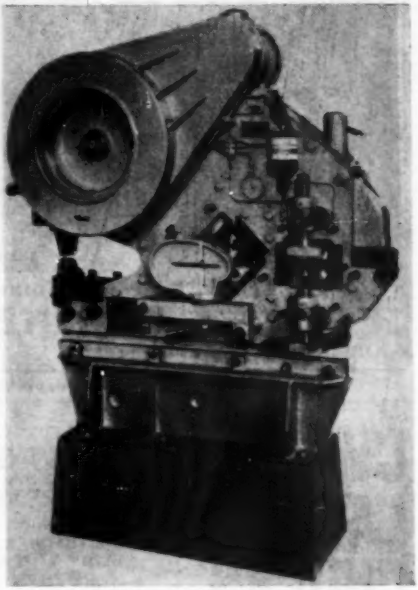
MADISON-KIPP CORP.
207 Waubesa St., Madison 10, Wis., U.S.A.
Use postpaid card. Circle No. 343

Universal Iron Workers In 5 Sizes From ⅜" to 1" Cap.

The Sacma universal iron workers for five operations feature five sizes from ⅜" to 1" shearing capacity. Hermes Machine Tool Co., Inc., is exclusive distributor for these iron workers.

The frames are made of heavy rolled steel plates, electrically welded into one solid unit and unbreakable. All shafts and other working parts are made of chrome nickel alloy steels. Centralized one shot lubrication is featured.



Centralized one shot lubrication featured.

The knives for angles and Tees are separate from the knives for round and square bars and are mounted on independent slides. Knives for I-Beams, U-Channels and Z-Sections are easily and quickly exchanged. The shearing blades and knives for round and square are reversible and can be used in eight different positions.

Hermes Machine Tool Co., Inc., Long Island City, N.Y.

Use postpaid card. Circle No. 94

Toolholder Features Adjustable, Carbide Chip-Breaker

The Carboloy Adjust-O-Breaker features an indexing, fully adjustable carbide chip-breaker which provides positive settings. The adjusting screw passes through a hole in the base of the movable locating pin which provides for an infinite number of settings and once set is not disturbed by loosening of the clamp to index, or change, the disposable tool. All cutting force is taken on the keys and major clamp screw. Five styles are offered in three sizes.

Metallurgical Products Dept., General Electric Co., Detroit, Mich.

Assembly details of toolholder.

Use postpaid card. Circle No. 95

The S-22 MICROFINISH COMPARATOR

GAGE SURFACE FINISH TO NEW A.S.A. STANDARDS - *Quickly - Accurately*

This convenient pocket comparator has 22 precision surfaces for specifying and controlling finish to the new A.S.A. Standard B46.1 - 1955. Electroformed in durable corrosion-resistant nickel, the S-22 Comparator provides every department with the most inexpensive method for uniform, accurate control of finish characteristics.

Save valuable time in engineering, inspection, quality control — eliminate costly overfinishing in purchasing and production. $17.50 complete with leather case.

Available from leading industrial distributors, or write

FDL **FAIRFIELD DEVELOPMENT LAB., INC.**
(SUCCESSOR TO BAPTIST MACHINE CO.)
38 Ludlow Street, Stamford, Conn.

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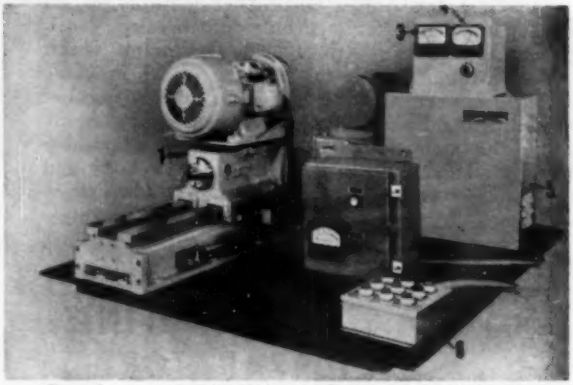
Deep Hole Drilling Machine Assembled By Purchaser

This package consists of six components needed to assemble a precision deep hole drilling machine capable of gun-drilling or boring finished holes in one pass, from the solid, eliminating many secondary and troublesome operations. These components are as follows:

1. Boremation — deep hole drilling power unit.
2. Spindle Load Meter—that tells variations in the workpiece.
3. Feed Rate Meter—indicates ipm of drilling, etc.
4. Spindle Tachometer — indicates spindle rpm.
5. Electrical Control Cabinet—J.I.C. standards.
6. Control Panel—allows machine to be run in or out of sequence and repositions as required.



The six components of the package are pointed out.

These versatile Module Boremation power units are reported ideal for machining soft metals, like aluminum,

Use postpaid card. Circle No 345

or the new tough alloys used in the aircraft and missile industries.

Spindle speeds up to 10,000 rpm can be obtained with any combination of feed rates, from .0001" to .025" per revolution. Mechanical models have strokes to 60"; hydraulic models, to 24".

Drillmation Co., Inc., Center Line, Mich.

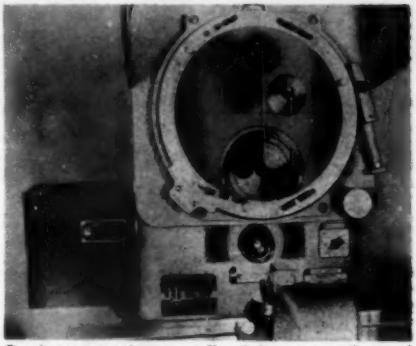
Use postpaid card. Circle No. 96

Inspection by Reflection For J&L FC-14, TC-14 Comparators

A normal reflection unit for all J&L FC-14 and TC-14 optical comparators is designed to produce the maximum amount of reflectivity, regardless of the surface finish of the part being inspected.

A front surface, spherical reflector adds at least 55% to the effective light given by a 1200-watt lamp. The firm also reports that all heat is dissipated before entering the optical system of the comparator. Depth of focus of up to .100" can be obtained.

This high-intensity unit is reported as not limited to low magnification



Produces maximum reflectivity, regardless of surface finish of part inspected.

projection lenses, with metallographs easily taken, at 50X, to determine the depth of carbonization and grain structure.

Jones & Lamson Co., Springfield, Vt.

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NOTHING heats like...
is more modern than...
is more economical than... GAS
NO BLOWER OR POWER NEEDED
BUZZER
REG U S PAT OFFICE
JUST CONNECT TO GAS SUPPLY
INDUSTRIAL GAS BURNERS & FURNACES
for Clean, Fast, Quiet Heat-Up at Lowest Cost!
BENCH TYPE OVEN FURNACES
For heat treating and pre-heating. Temperatures to 2000° F.
ATMOSPHERIC POT FURNACES
For cyanide, salt bath and lead hardening. Temperatures to 1650° F.
Write for complete "BUZZER" CATALOG
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"BUZZER" Burners & Furnaces for Heat Treating, Melting, Soldering

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New Drill For the Aircraft Industry

Wire gauge, letter, fractional sizes.

A new drill, made of 8% cobalt super high speed steel for more holes per drill, is designed to be used in high strength aircraft and missile materials. The special split point is said to provide maximum penetration rate for production drilling of high strength alloys. The new construction provides maximum rigidity with short, sturdy flutes. Drills are offered in wire gauge, letter and fractional sizes with jobbers' lengths.

Chicago-Latrobe, Chicago, Ill.

Use postpaid card. Circle No. 98

HISEY

SO MUCH QUALITY FOR SO LITTLE COST

Low cost and high quality continue to typify the Hisey line as they have for fifty years. Hisey is the veteran company of grinder, buffer and polisher manufacturers . . . making both general purpose and heavy duty lines. Write today for full information.

OF CINCINNATI

Infinitely Variable Speed Buffer 1 to 15 HP
3 JA Drill Grinder with one drill holder
Pedestal Grinders — 10", 12", & 14" ¾ to 5 HP
Precision Grinder ⅛ to 10 HP 4" to 20" Wheels

Hisey

THE HISEY-WOLF MACHINE CO.

364 MT. HOPE AVE.

Cincinnati 4, Ohio

The Hisey Line is The Complete Line.
Also Manufacturers of Super Precision SPINDLES, SLIDES & FEEDS.

Use postpaid card. Circle No. 347

Magnetic Dial Indicator Holder

A new Magna-Holder provides for rapid mounting of dial indicators and affords versatility in the application of dial indicators to surface plate inspection or for controlling fine machine adjustments or feed movements. A swiveling clamp permits angular adjustments of the dial indicator to the working position. It is said the device will not creep during mounting as a result of machine vibration.

Mueller Gages Co., Div. of Mueller Laboratory, Pasadena, California.

Will not creep during machine vibration.

Use postpaid card. Circle No. 90

* Removing chips, shavings, filings, and airborne debris that clog machinery, distort tolerances, mar product finishes.

* Controlling mists and fogs in wet machining operations.

* Recovering valuable dusts, coolants, heated air.

* Protecting machinery investments with preventive maintenance.

FREE...latest specs and data on TORIT Dust Collectors for handling these and other air pollution problems. TORIT: the high efficiency line with savings up to 1/2!

* Reducing absenteeism with improved health and safety precautions.

WRITE TODAY:

TORIT MANUFACTURING CO.

1133 Rankin St., St. Paul 16, Minn., Dept. 614

Use postpaid card. Circle No. 348

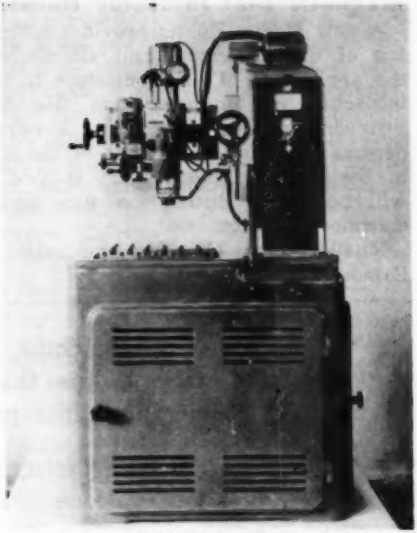
Electric Erosion Machine Has Improved Electric System

The new model E-500 electric erosion machine, for the rapid and accurate machining of tungsten carbide, hardened steel and other metals by the electric erosion process, provides many improvements over the previous E-400 model.

All the electric equipment is now located in the head of the machine, which can be swung open for inspection or repairs. A new auxiliary motor has been added to raise the entire head of the machine when necessary during set-ups—formerly done by hand.

The electric system has been improved to allow the attainment of a superior finish—as high as No. 10 microfinish, it is claimed.

Horizontal automatic feed, besides the vertical one, is standard equipment in this machine. A threading attachment, for cutting threads up to 1½", is optional.



Superior finish of No. 10 microinch.

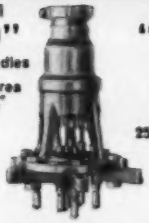
Electro-Spark Co., Inc., N.Y.C.

Use postpaid card. Circle No. 100

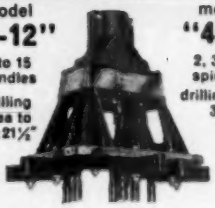
For LOW COST Hole Production

model "900"
2 to 8 spindles
drilling area to 22½"

model "500"
2 to 8 spindles
drilling area to 18½"

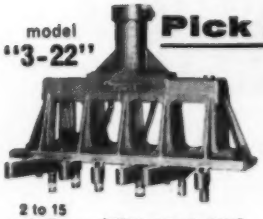


model "8-12"
2 to 15 spindles
drilling area to 25½"x21½"



model "400"
2, 3 or 4 spindles
drilling area 3½"

model "3-22"



2 to 15 spindles — drilling area to 35½"

Pick a MULTI-DRILL to Fit the Job

Commander MULTI-DRILLS — adjustable multiple spindle drill press attachments—are sold and serviced by a nation-wide network of Commander Distributors—experienced, helpful specialists in solving drilling and tapping problems. Write for the name of your nearest Distributor and the complete Commander Production Tool Catalog which contains full details on every MULTI-DRILL and many other production drilling and tapping tools.

104

Commander MFG. CO. 4227 WEST KINZIE STREET CHICAGO 24, ILLINOIS

Use postpaid card. Circle No. 349

Direct Dial Dimensioning System

Diatrol, a new direct dial dimensioning system developed exclusively for DeVlieg Spiramatic Jig-Mils, is a simplified and accurate means of presetting dimensions for automatic point-to-point positioning. By eliminating use of measuring rods, the system allows direct dialing of positive or negative dimensions from any arbitrarily selected datum plane within the range of the control system. Absolute measuring accuracies, well within the tolerance range of the JigMil, may be selected repeatedly.

DeVlieg Machine Co., Royal Oak, Mich.

Dialing the dimensions.

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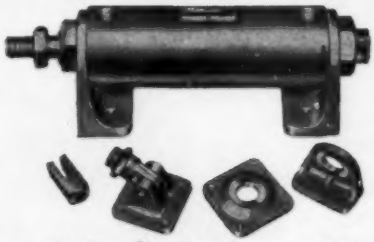
Modernair

ECONOMAIR CYLINDERS

Tops in Quality, Economy, Compactness!



For Air or Hydraulic Service to 200 psi

- ★ Compact—feed ring head design eliminates bulky end castings!
- ★ Interchangeable mountings—flange, clevis, L-type
- ★ "O" ring seals throughout
- ★ Available in 1⅛", 1½", 2", 3" and 4" bore sizes, any practical stroke length, cushion or non cushion types

Economair series cylinders offer today's best buy in quality cylinders at truly competitive prices—why pay more and get less? Write today for complete specifications, prices.

Modernair CORPORATION

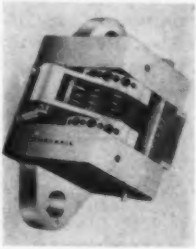
Trademark

Dept. N-12, 400 Preda St., San Leandro, Calif.
5007 Brookpark Rd., Cleveland 34, Ohio

Use postpaid card. Circle No. 350

RELEASING TAPHOLDERS. The self-aligning Tool-Flex holder is said to give positive, full-floating drive while compensating for tap lead variations with the machine feed. Perfect follow-up with prevention of tap breakage is reported. The five basic parts are: body, neoprene float, retainer ring, collet and sleeve. The full-floating feature corrects for both angular and parallel machine spindle misalignment. A full range of standard sizes are stocked. Burgmaster Corp., Gardena, Calif.

Use postpaid card. Circle No. 102

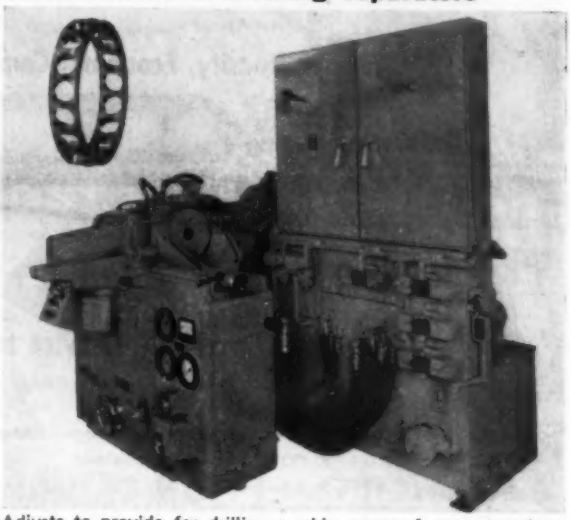


3-IN-1 METAL STAMPING MACHINE. The new Model 52 stamps where markings are necessary above serial number. Automatic numbering, serial or model number, and trade name or insignia—these three markings are combined in one operation. It is reported the model is sturdy, accurate, and long lasting, providing greater flexibility in metal marking. Available with flanges or shank to fit the press. Numberall Stamp & Tool Co., Staten Island, N.Y.

Use postpaid card. Circle No. 103

Automatic Drilling Machine Drills Ball Bearing Separators

A new automatic drilling machine is designed especially to drill cages or separators for precision ball or roller bearings. It is completely automatic in operation and has adjustments to provide for drilling a wide range of sizes of separators. The index mechanism can accommodate any number of holes by changing index plates. All operations are performed hydraulically, including the rotation of the spindle which allows flexibility in selecting the proper spindle speeds and feeds for maximum production in drilling different materials. The push button control station provides for independent operation of each motion of the machine to facilitate set up. All motions are interlocked to prevent damage.



Adjusts to provide for drilling a wide range of separator sizes.

Silicon iron bronze separators requiring 22 holes, .718" dia., .560" deep, were drilled accurately to depth at the rate of 45 separators per hour, it was reported. Previous production was 8 per hour.

The present machine will handle separators 4" dia. to 10½" dia., width 11/16" minimum and drill dia. 1⅜" in bronze.

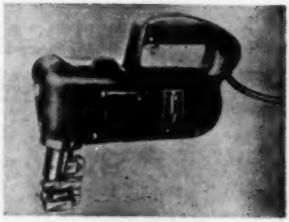
B. M. Root Co., York, Pa.

Use postpaid card. Circle No. 104

Nibbler Cuts Without Distortion

The 8 lb. Model HN Fenway Nibbler, designed for heavy duty ferrous or nonferrous metal cutting operations, is said to nibble away at down time and eliminate grinding and buffing operations. The punch and die principle is also reported to assure low cost operations. The nibbler cuts up to five feet per minute, and can cut ten gauge stainless steel or eight gauge mild. This is cutting on both sides of the sheet without distortion, the company claims.

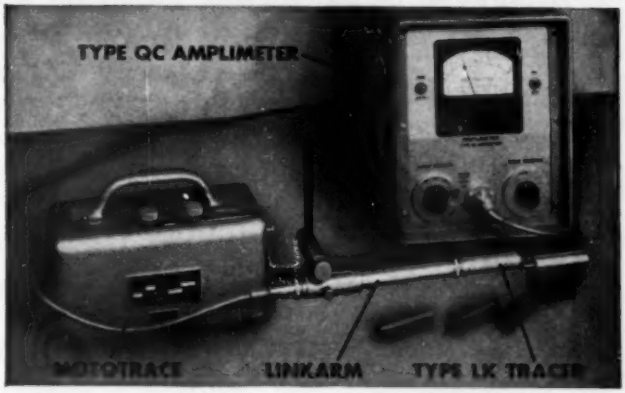
Fenway Machine Co., Philadelphia, Pa.



No grinding, buffing needed.

Use postpaid card. Circle No. 188

NEW! Profilometer® GROUP III



Measures Roughness of Surfaces from 1/8" to Flat — ID and OD

NEW Type LK Tracer measures on ID's and OD's as small as 1/8"; flats; tapers; narrow splines; gear teeth.

NEW Type QC Amplimeter shows roughness from 0 to 1000 microinches (arithmetical or r.m.s.) on easy-to-read meter. Has 3 standard roughness width cutoffs. Lightweight and portable; built for shop use; factory-calibrated for dependability.

WRITE for descriptive literature.

Profilometer is a registered trade-mark.

MMC ® MICROMETRICAL MANUFACTURING COMPANY

345 S. MAIN ST., ANN ARBOR 4, MICHIGAN

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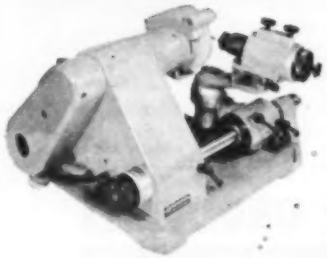
UNIVERSAL CUTTER GRINDER



for all commonly used engraving and milling cutters up to 3/8" dia.
High Precision Unit

ANTARES INSTRUMENTS, INC.
55-02 37th AVE. WOODSIDE 77, N.Y.

Use postpaid card. Circle No. 438

Tough New Plastic With High Rigidity

Kralastic MM, a tough new plastic, is a resin-rubber blend specifically designed for molding products where high rigidity and resistance to cold flow under loads are required. Its rigidity is reported about twice that of nylon, and its resistance to creep four times greater.

The new plastic is said to have low moisture pick-up, good impact strength and high abrasion and corrosion resistance, withstanding heat up to 200°F.

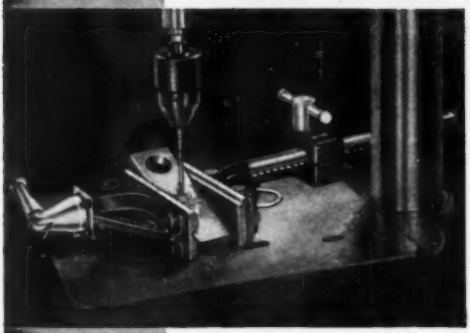
Quantity price of the product is $.50 per lb. It is available in a range of colors.

Naugatuck Chemical Div., United States Rubber Co., Naugatuck, Conn.

Use postpaid card. Circle No. 107

Speed production . . . cut costs with

INSTANT CHANGE



AUTOMATIC KEYLESS CHUCK

Lets you change tools *in seconds* without stopping the spindle. One chuck does the work of several spindles, won't chew up tool shanks. The greater the torque, the tighter the grip.

DRILL PRESS VISE

Floats and locks *instantly*, positively, in any position on table. Holds work safely for accurate drilling and tapping. Two models: 9" and 12" capacities.

Write for illustrated folder and name of nearest distributor to AMF Tool Division, American Machine & Foundry Company, 224 Glenwood Ave., Bloomfield, N. J.

AMF **WAHLSTROM®** AUTOMATIC CHUCKS / **FLOAT-LOCK®** SAFETY VISES

Use postpaid card. Circle No. 352

T-Slot Cleaner

This T-slot cleaner is claimed to cut clean-up down time, as well as eliminating the hazard of removing chips with air. The other end of the cleaner is used as a scoop to spoon chips from pockets at ends of machine tables.

Two sizes are offered—one with blade width of 31/32" and the other, 1¼". Each is 9" long. The price is $1.25 each.

Reid Tool Supply Co., Muskegon Heights, Mich.

Other end used as scoop.

Use postpaid card. Circle No. 108

With heavy duty, rubber tired, ball bearing wheels and one piece fold-down handle, the Wells Model 49A is a metal cutting band saw that's REALLY MOBILE . . . and VERSATILE. Use the 49A as a horizontal cut-off machine (capacity 3½" x 6") or swing the head to vertical position . . . it's an upright band saw.

The optional wheel and handle unit, available for new machines and those already in service, is a tremendous time and labor saver. Ask your local Wells Distributor for details . . . or write for Bulletin 253-H.

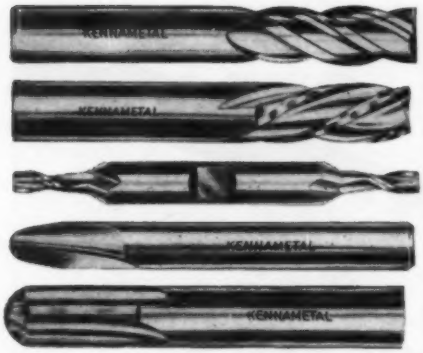
Wells

The Pioneers of Horizontal

METAL CUTTING BAND SAWS

WELLS MANUFACTURING CORPORATION
707 Coolidge Ave., Three Rivers, Michigan

Use postpaid card. Circle No. 353



NOW... A COMPLETE LINE OF SOLID KENNAMETAL* END MILLS

stocked for immediate delivery

Now, Kennametal Inc. offers you a complete line of solid, precision-ground end mills of the same consistently high quality tungsten carbide used for years in other types of Kennametal cutting edges for the metalworking industry.

For every job requirement. Stocked in fifteen different styles, new Kennametal End Mills are available in diameters from 1/16" to 3/4" . . . a size and style to match your milling requirements.

For better finish. Kennametal has an extremely high YME . . . up to 94 million psi . . . three times that of hardest steel. High hardness, plus one-piece construction, provides maximum rigidity for smooth, even finish to meet high precision requirements.

For longer life. Kennametal End Mills are all-carbide . . . eliminate brazing failure, and provide maximum resistance to heat and abrasion.

New 12-page Catalog now available. Ask your Kennametal Representative or write Kennametal Inc., Latrobe, Pa.

*TRADEMARK 97233

INDUSTRY AND KENNAMETAL ...Partners in Progress

Use postpaid card. Circle No. 354

High Frequency Grinding For Rivett No. 84 Internal Grinder

A high frequency spindle providing speeds up to 100,000 rpm is now offered on the standard Model 84 internal grinder. Hole sizes from less than 1/8" dia. up to 3" may be ground to a micro inch finish, it is reported. The spindle has oil mist lubrication and is water cooled. Furnished with the spindle are arbor chucks, suitable for holding carbide burrs or mounted grinding wheels.

The grinder is equipped with an automatic in-feed to provide .0006" to .00001" in-feed, for the successful grinding of thin-wall pieces for any job requiring extra light metals.

High frequency spindle & driving unit is furnished as a package.

The high frequency alternator, the oil mist lubrication system, the coolant tank and the control panel are mounted in a separate cabinet adjacent to the machine, easily reached by the operator.

Rivett Lathe & Grinder, Inc., Boston.

Use postpaid card. Circle No. 109

WIND YOUR OWN

SPRINGS

Porter Spring Winder

Widely used to make springs to 1¼-inch I. D., for repair, experimental work and small production runs. Low in cost. Handles wire to 3/16" diameter. WRITE FOR CATALOG.

ADVANCE CAR MOVER COMPANY, INC.
APPLETON, WISCONSIN

Use postpaid card. Circle No. 439

New High-Speed Color Motion Picture Film

A new, high-speed, color motion picture film is seen as a major advance for in-plant cinematography. Called Eastman color reversal film, Daylight Type, SO-260, the film has a normal exposure index of 160 (sixteen times as sensitive to light as Kodachrome movie film).

Eastman Kodak Co., Rochester, N.Y.

Use postpaid card. Circle No. 158

"Specialization Creates Perfection"

Comet. BORING TOOLS

(H. S. S. and Carbide) for Holes from 1/16" upward

Standard and Special Boring, Facing and Internal Threading Tools. Write for Data.

Bore Small Holes? Contact COMET

COMET Tool Co.

738-BI BROADWAY • NEW YORK 3, N. Y.

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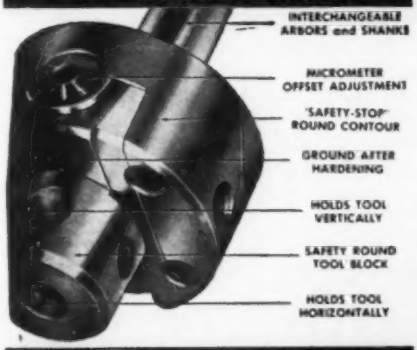
7 REASONS WHY FLYNN BORING HEADS ARE MOST USED



LEADING NAME IN BORING HEADS FOR 40 YEARS

19 MODELS *Write for catalog*

FLYNN MANUFACTURING CO.

18301 WEAVER • DETROIT 28, MICH.

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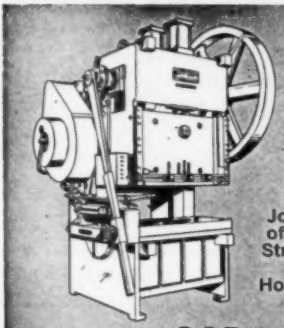


Write today for BULLETIN 1958

Complete "specs" on Johnson line of Inclinable, Straight Side. Gap and Horn Presses.

GAP

Johnson

POWER PRESSES

JOHNSON MACHINE & PRESS CORP.

620 W. INDIANA AVE., ELKHART, INDIANA

Use postpaid card. Circle No. 355

SPELLMACO "SPOTTERS"

A matched set of transfer punches for toolmakers, machinists & tool cribs

Used for transferring location of threaded, drilled and reamed holes, slugs, blanks, etc.

Precision made of finest tool steel—Carefully heat treated and tempered for long life—.0025 undersize to facilitate use—Black oxide finish

Set No. 3-17, 28 punches with indexed stand—sizes 3/32" to ½", by 1/64"—plus handy 17/32" size. Length 4⅞" ONLY $17.90

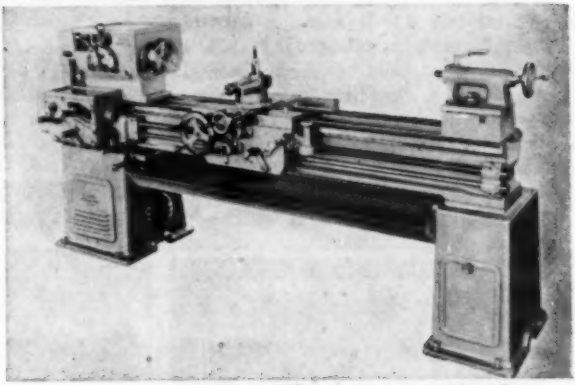
Single sizes available

R. L. SPELLMAN CO. - URBANA, OHIO

Use postpaid card. Circle No. 356

All New Geared Head 18" Engine Lathe

The 5 hp motor for this GH 18" engine lathe is conveniently mounted in the cabinet. The all-geared headstock is designed for convenience, power and durability with 12 spindle speeds, ranging from 20 to 900 rpm, obtained through two speed handles.



12 spindle speeds—20 to 900 rpm—two speed handles.

A new improved friction type clutch and brake affords instantaneous spindle control, allowing the motor to run constantly. Lubrication of the headstock is by splash system, the parts running in a constant oil bath. A quick change gear box is furnished with 48 separate threads and feeds. Threads three to 184 per inch are available through the gearbox levers.

The standard bed casting is heavy, rigid, cross ribbed, first grade iron semi-steel metal with close grained composition. Additional equipment is also available.

In addition to the 18" lathe, the man-

DRILL HARDENED STEELS WITHOUT ANNEALING —

With the new, improved "HARDSTEEL" Drill, you can do accurate, smooth drilling, countersinking, counterboring and reaming in steels hardened by any process without first annealing the work. And they work with equal ease on work-hardening steels and high carbon - high chrome steels of any degree of hardness. "HARDSTEEL" Drills fit standard drill presses. They save time and reduce rejects. They permit engineering changes requiring additional drilling after hardening. And parts drilled after hardening always match at assembly. *Write for a copy of the "HARDSTEEL" Operators Manual showing how "HARDSTEEL" Drills are cutting costs in thousands of plants.*

BLACK DRILL COMPANY, INC.
1374 East 222nd Street • Cleveland 17, Ohio

YOU HARDEN IT —
WE'LL DRILL IT WITH — "HARDSTEEL"

Use postpaid card. Circle No. 358

ufacturer also offers a 16" lathe—both available with short, medium, or long beds.

Carroll-Jamieson Machine Tool Co., Batavia, Ohio.

Use postpaid card. Circle No. 154

Mold Release Oil Prevents Adhesion of Metal to Mold

Sun Oil Co. announced a new Sunoco mold release oil developed to meet the special requirements of the die casting industry. It is reported that the new oil has improved mold release properties; prevents adhesion of casting metal to the die mold; gives bright, stain-free casting surfaces, and produces die castings with less porosity.

The new oil is described as a substantial advancement in die casting lubricants because it develops comparatively less fog during die casting operations and gives excellent lubrication, which minimizes wear on guide pins and bushings.

Sun Oil Co., Philadelphia, Pa.

Use postpaid card. Circle No. 111

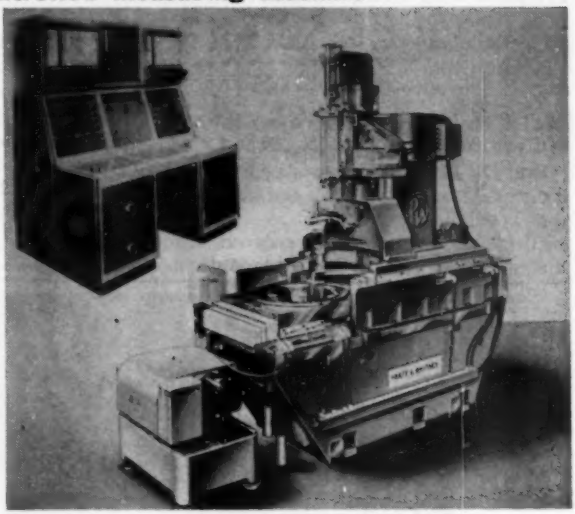
Quality
That's the word for Clearing Torc-Pac. It is thoughtfully designed, carefully built to take advantage of every economy. Result? A fine machine that tops anything in its field—by far. Price? Very reasonable. But find out for yourself . . .
Write for Torc-Pac Bulletin
USI Clearing
DIV. OF U. S. INDUSTRIES, INC.

Use postpaid card. Circle No. 359

No Need For Special Templates and Tooling With Numerically Controlled Measuring Machine

A new, numerically controlled gaging machine has been developed to check components of practically any shape at any desired number of coordinate points of their inner or outer surfaces.

Known as the Data-Limit 6 coordinate measuring machine, this instrument has two gaging arms, with each arm capable of movement in the X, Z and Theta coordinates — horizontal and vertical movement plus rotary motion around the X and Z coordinates. Operation is fully automatic.



Data-Limit 6 coordinate measuring machine & operator's console.

Input data carried on an easily pre-

BLUE VALLEY

FLANGING MACHINES and CIRCLE SHEARS

No. 1 10 Ga. Circle Shear and Flanger.

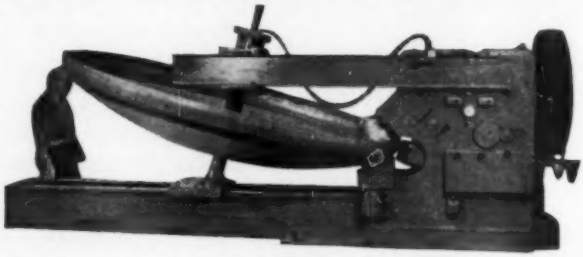
No. 3 ¼" Cap. Flanger for flat heads.

No. 4 ⅜" Cap. Flanger for flat and dished heads.

No 5 ½" Cap. Flanger for flat and dished heads.

No. 6 ⅝" Cap. Flanger for flat and dished heads.

No. 56 Model 3/16" Cap. Elliptical Head Shear and Flanger.



No. 60 ⅜" capacity circle shear with a 23" throat.

No. 40 ⅜" capacity circle shear with a 15½" throat.

Above machine a No. 7, ¾" capacity. Shown with a ¼" x 9' 6" dia. stainless steel head with a 6½" knuckle radius. Can go up to as high as an 8" knuckled radius.

BLUE VALLEY MACHINE & MFG. CO.

6832 Truman Road KANSAS CITY 26, MO.

Use postpaid card. Circle No. 360

pared perforated tape is used to move the gaging arm and head to a reference point on the workpiece and then to position the gage head at a desired series of points in space. At each point the gage head measures the deviation of the workpiece surface from its nominal location. The measuring machine is also equipped with digital readout, which makes it possible to store, record or mathematically process the gage data in almost any desired manner.

The manufacturer emphasizes that the use of a perforated tape eliminates the time and expense of preparing templates and other special gage tooling.

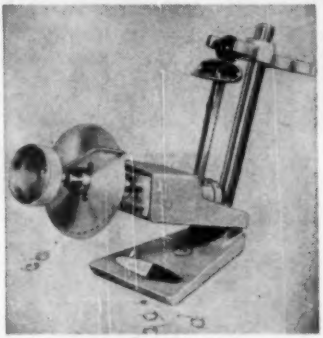
Pratt & Whitney Co., Inc., West Hartford, Conn.

Use postpaid card. Circle No. 112

Torsion Spring Tester

A new fixture for rapid testing of torsion springs features interchangeable arbors and 360° protractor. Additional arbors to fit special springs can be obtained. This tester embodies a torque wrench as a sensing element, allowing various ranges from inch-grams up to 100 inch-pounds.

This basic unit can also be used for direct torque testing without modification. The unit is well adaptable to the testing and setting of small torque screw drivers.



Has interchangeable arbors & 360° protractor.

P. A. Sturtevant Co., Addison, Ill.

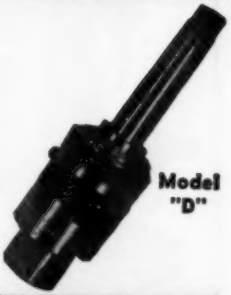
Use postpaid card. Circle No. 113

THINK of it!

NOW you can have a boring head that will **BORE, FACE, TURN** and **GROOVE** at no higher cost than you would pay for an ordinary, single purpose boring head.

THINK this over before buying that new head!

A Boring Head That Won't Face is NOT Complete



Model "D"

Models for Any Size Machine

Write today for full details

CHANDLER TOOL COMPANY

MUNCIE, INDIANA

COMBINED BORING & FACING TOOL HEADS

Chandler-Duplex

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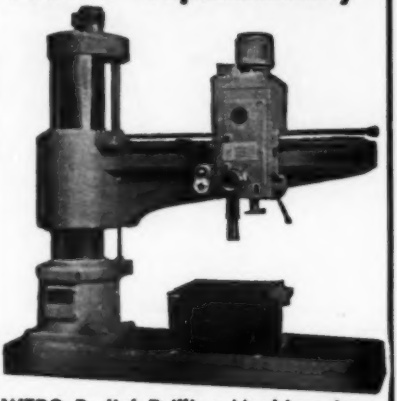
DRILL PRESSES
OF
Proven Dependability



WEBO Radial Drilling Machines from 2½' Arm with 9½" Columns to 8' Arm Machines with 19¾" Column.

"WEBO"

World Famous Radial and Upright Drilling Machines.
High speed sensitive type to heavy duty upright and radial models.

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Hundreds in use throughout the United States. Outstanding in performance and low in first cost and maintenance.

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WEBO Upright, sensitive and multiple spindle drilling machines. Up to 2½" capacity.

Ask for Literature and Prices for your requirements.

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Factory Distributors

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Square File Handle For Correct Grip

Brilliant orange, black-capped file handles combine comfort in the hand, light weight, and durability. They are designed and produced by Danielson Manufacturing Co., Danielson, Conn., for its parent organization, Nicholson File Co.

The plastic handle affords correct file grip, and is square in section to prevent rolling.

Nicholson File Co., Providence, R.I.

Use postpaid card. Circle No. 114

Small Electrostatic Chuck Holds Metals, Non-Metallics

A smaller production model of the new Electroforce electrostatic chucking system now available has allowed pre-

reliable
ONE SOURCE FOR ALL YOUR GEAR NEEDS
Abart

Every Abart gear is precision-cut to the customer's exact specifications. We carry no stocks!

Abart has complete gear-cutting facilities to promptly supply the exact gear you want — spiral, bevel, helical, internal, worm, rack and sprocket — in any quantity, any material, from 5/7 D.P. to 96 D.P. — ¼" P D to 18" P D

Send B/P or specs Ask for quote

Write for Abart Gear Bulletin

ABART GEAR and MACHINE CO.
4829 West 16th Street • Chicago 50, Illinois

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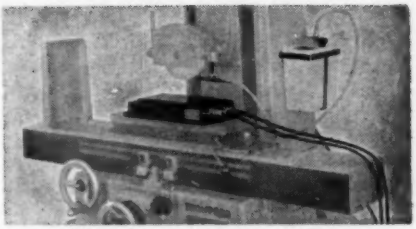
cision surface chucking of non-magnetic metals and even non-conductors. With 5" x 8" work-holding surface, it has been developed primarily for use in experimental shops, tool rooms, and for small-run production. It is reported comparable in precision performance with larger units.

The chuck is complete with compact power supply, mist dielectric coolant unit, stops, dresser holder, fluids, and recoating kit.



5" x 8" work-holding surface.

Electroforce, Inc., Fairfield, Conn.

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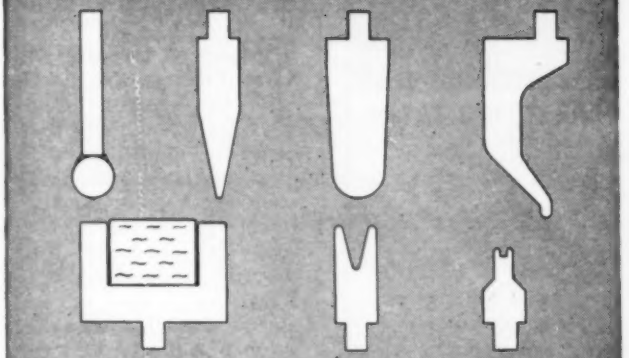
Alloy Forming for
AIRCRAFT
MISSILES
ROCKETS
and
OTHER FABRICATIONS

CHICAGO
ALLOY-FORM DIES
For All Makes of Press Brakes



Here are a few of the commonly used types of CHICAGO Alloy-Form dies available for prompt delivery. For further data ask for Bulletin AFD-958. Complete recommendations and quotations on Alloy-Form dies or any special die upon request.

CHICAGO

DREIS & KRUMP
MANUFACTURING CO.
7440 S. Loomis Blvd., Chicago 36, Ill.

Press Brakes • Press Brake Dies • Straight-Side-Type Presses
Hand and Power Bending Brakes • Special Metal-Forming Machines

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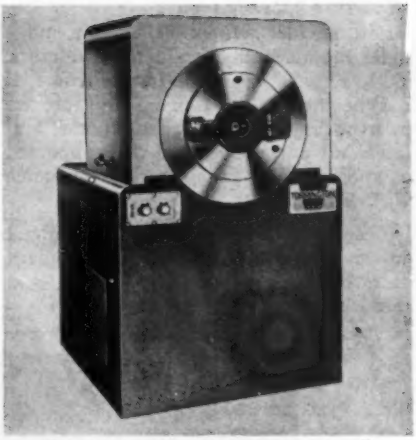
Unit Points Solid Stock to ½", Tubular Material to 1½" Dia.

A new pointer for steel, aluminum and brass mill applications has been added to the expanding line of Torrington rotary swaging machines. It is claimed to point solid stock up to ½" dia. and tubular material up to 1½" dia.

Unit is specifically engineered to handle mill operations, particularly where fast pointing and quick die changes are necessary.



For steel, aluminum, and brass mill applications.

Swaging Machine Div., The Torrington Co., Torrington, Conn.

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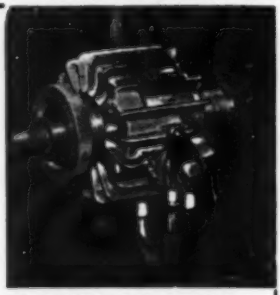
WILSON AIR COLLET CLOSER



STEP UP PRODUCTION 20%+

. . . for most lathes to 1" bar stock capacity

- Hold delicate parts without damage or adjustment
- Iron grip for heavy work
- No adjusting for stock or part variations
- Fingter-tip or foot control eliminates operator fatigue
- Eliminates jarring of head stock

(Ten day FREE TRIAL to reliable firms)

WILSON AIR COLLET CLOSER, INC.
909 40th Ave. NE, Minneapolis 21, Minn.

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Welded Hydraulic Fluid Line Tubing Easily Bends

Welded hydraulic fluid line tubing is being offered which can be flared and bent easily to meet any service condition. The welded tubing has been approved by the Joint Industry Conference and is said to be from 20% to 30% less expensive than J.I.C. approved seamless tubing.

Sizes range from ¼" to 1¼" dia. inclusive, in wall thicknesses from 13 ga through 20 ga.

Joseph T. Ryerson & Son, Inc., Chicago, Ill.

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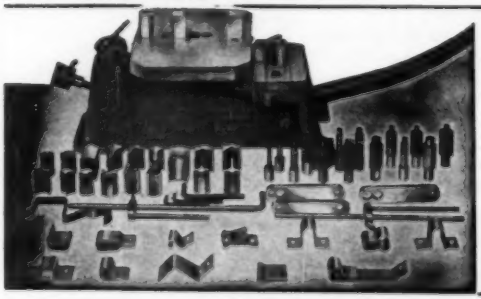

Multiform BENDER CUTTER

CUTS, BENDS, PUNCHES

Available in hand, air and hydraulic models, the MULTIFORM is shipped complete with full assortment of dies and mandrels to punch, bend, and cut round or flat brass, bronze, aluminum, steel, etc., up to ⅛" x 1½" as illustrated, other models up to ½" x 8"

J. A. RICHARDS CO.
KALAMAZOO, MICH.

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COMPARE

Spraymist®

ENGINEERED BY **BIJUR**

Only Spraymist Provides

- **Compact, Unit Design** — Includes *ALL* necessary controls: — Trap-Filters — Regulator — Gauge — Solenoid Valve — Reservoir.
- **Automatic Operation** — Mist starts and stops automatically with machine.
- **Pressurized Reservoir** — Prevents clogging or siphon lift problems — Provides more uniform flow — Permits extending system to as many jets as needed.
- **Precision Mist Control** — Needle Valve at each jet allows for convenient control of uniform, continuous mist, from superfine to heavy spray — Easily replaceable jet tips.

plus: Machine tool styling — Fully protected against corrosion — Sturdy construction — Choice of 18 ounce, 1 gallon or 5 gallon reservoir capacity.

Write today for Bulletin MTF-7, and the name of your nearest SPRAYMIST *distributor.*

2054

A product of **BIJUR** LUBRICATING CORPORATION
Rochelle Park, New Jersey

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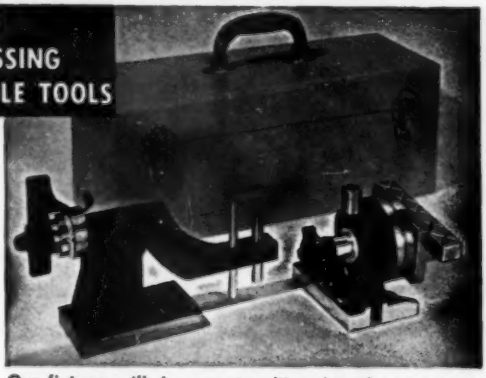
Now ANGLE TANGENT TO RADIUS WHEEL DRESSING WITH NEW VERSATILE TOOLS



MIGHTY GOOD AT ANY PRICE BUT TOPS AT ONLY $149.50
(Both tools including diamonds)

The G-5 RADIUS DRESSER is a precision engineered tool that will dress either a convex or a concave radius from .015" to 1.750" on a 7 inch or 10 inch wheel, and it may be set to the exact radii desired. Graduated stops allow you to dress any desired portion of a radius. The spring tension journal insures chatter free operation. The G-2 ANGLE DRESSER AND TOOL HOLDER is actually two tools in one, having an easy to read vernier scale 0° to 180° giving accuracy within 2" of 1°; an excellent time saver to set up small jobs to be milled, drilled, tapped, etc., on any desired angle.

Our fixtures will dress most radii and angles tangent to each other, similar to those shown below.

FREE handsome, wooden storage box. Write for complete information.

Distributorship available in select territories.

ROTH FUSS TOOL COMPANY

BOX 2694, ELMWOOD STATION — PROVIDENCE 7, R. I.

Use postpaid card. Circle No. 367

More Die Space, 3 Shut Heights In New 8 Ton Punch Press

This Series "90" 8 ton O.B.I. power punch press is designed for jobs requiring unusual vertical or horizontal die space. A choice of 3 shut heights with standard 1¼" stroke (stroke down) is available: 7¾", 10¾", or 13¾". These measurements are without bolster plates. Other strokes of 1½, 2, 2½ and 3" can be supplied on order as well as strokes 1" and less. The press operates at 180-190 spm on a direct drive when using a ½ hp, 1725 RPM motor. Bed area is 8" x 11" with 12" clearance between center of slide and frame.

Available are both direct belt drive and back geared models. Geared models develop 40 to 100 spm. The press is recommended as a floor model.

Benchmaster Manufacturing Co., Gardena, California.

In direct belt drive and back geared models.

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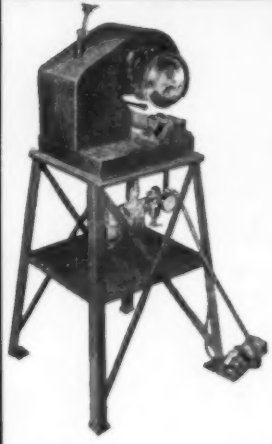

PAYS for ITSELF

NO MATERIAL LOSS

Continental **PIPE AND TUBE**

Rotary Cut-Off Machine

It zips right through tubes from ⅜" to 1¼" O.D., from light gauge to 16-gauge wall thicknesses. Adjustable table with Tri-Roller Assemblies and Manual Stock Loader. Also *Cut-Off Machines up to 12" diam., air or hand-operated.*

Machine Rental Plan

Cuts up to 2,000 tubes per hour

SINCE 1919

Continental **machine co.**

2345 W. NELSON ST. • CHICAGO 18, ILL.

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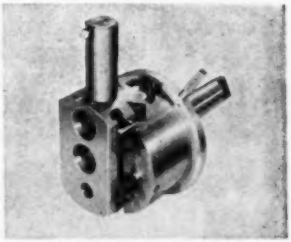
Continuous-Feed Facing Heads

Three new Davis continuous-feed facing heads (4", 6", 10" dia. bodies), designed for small-diameter boring, facing, turning operations, cover diameters from 7/16" to a recommended maximum of 25". They are available with standard or special shanks for spindle mounting or with flange adapters for sleeve mounting. A complete line of standard and special boring and facing bars, 90° holders, and pencil boring tools increases the variety of operations.

Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.



For dias. 7/16" to 25".

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BUYS TUNGSTEN CARBIDE
ON PERFORMANCE...
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If you are interested in improved efficiency, economy, quality — let's hear from you . . . the coupon is for your convenience.

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True Conical Grinding on a STERLING Drill Grinder gives you Faster Cutting Drills and More Holes per grind

Conical grinding of a drill point produces the same clearance angle from O.D. to web. The drill enters the work easier, cuts a uniform chip that requires less pressure, less power.

STERLING "DV"

$590.00

F.O.B. Eau Claire, Wis.

CAPACITY

90°—140° Included angle, variable clearance angle set with built-in gage. Grinds ⅛" to 2½" drills; 2, 3 & 4 flutes.

Set-up is simple and fast because no chucks or collets are used. Built-in diamond wheel dresser produces a finished cutting edge that stands up longer. You get more, accurate holes with drills ground on a STERLING "DV".

Ask your STERLING Dealer for complete information on all STERLING Drill Grinders or write direct

McDONOUGH MANUFACTURING CO.

1520 GALLOWAY • EAU CLAIRE, WISC.

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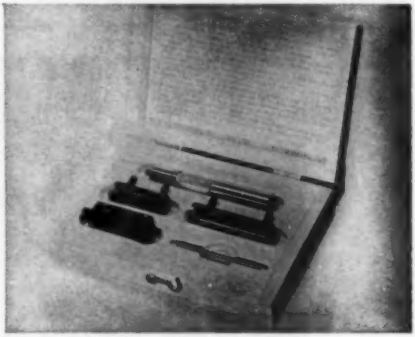
Checks Dial Indicator For Accuracy and Repeatability

Checkit checks in two minutes the accuracy and repeatability of more than 300 different makes, models and sizes of dial indicators, including toolmaker test types. The manufacturer also states that it checks special ranges up to 1.000", and all indicators graduated in .0001", .00025", .0005" and .001".

The value of the checker is that it



Checks indicators on the job.

can check the accuracy and repeatability of newly purchased indicators to verify A.G.D. specs., as well as detecting defective and sluggish indicators.

The unit comprises a master micrometer head and three adapters for coupling it to regular, test type or long range indicators for checking. Price is $38.00.

"Go-Devil" Instrument Co., Poughkeepsie, N.Y.

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Lewthwaite

Punches

Cutters

Benders

Catalog sheets covering complete line on request

T. H. LEWTHWAITE MACHINE CO.

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Tumico "SUPER-SET"

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revolutionary

disposable

TOOL ENDS

cut turning tool *costs* 2 3/4 rds

End-O-Con ENDS for cast iron work cost just $4 each! And ENDS revolutionary design gives you flexibility never before possible . . . just slip on to the same tool holder shank any common lead angle Ends.

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ENDS are investment castings hardened to Rc 43 with a tolerance of .003. There's an ENDS line for all your cutting jobs. Write for Brochure, or send for sample order.

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F.B.I.

ENDS Co., Inc.

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STANDARD HYDRAULIC PROBE UNIT, for single axis tracer control on any type machine tools, is equipped with a Pegasus hydraulic servo-valve. Two models offered have probe stable at operating pressures 200 to 3,000 psi. At 1,000 psi, Model TC-320 has 5 gpm cap. with flow rate of 1 gpm. per .001" stylus deflection. Model TC-340 operates at 10 gpm. cap. with flow rate of 2 gpm. per .001" stylus deflection. Operating temperatures range from 60° to 120°F. normal. Tracer Control Co., Hazel Park, Michigan.

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M.Q.BOLTEN
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☐ Check Cutter Grinder for sharpening your engraving cutters.

Check your cutter supplies. High Speed Steel, Tungsten Carbide, Diamond Cutters. ☐

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Write for complete details and prices. For immediate attention write directly to manufacturer below. Ask for nearest representative.

H. P. PREIS ENGRAVING MACHINE CO.
645 U.S. ROUTE 22, HILLSIDE, N. J.

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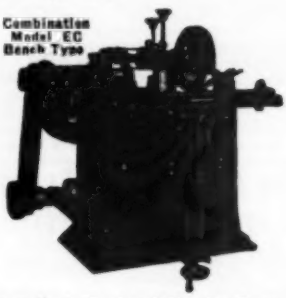
SAVE 80%

Wardwell's SAVE-A-SAW (Combination Model EC) pays for itself by sharpening only two gross of saws for you. Automatic—sharpens teeth as fine as 32 per inch.

Combination Model EC Bench Type



Sharpens Hack, Band and Circular Saws. Write for bulletin.

WARDWELL
3807 Ridge Rd. Cleveland 9, Ohio

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Dixie maintains true angle and radius to eliminate tangent groove as shown above.

DIXIE ELIMINATES HAND FINISHING

Dixie Tool leads the way in the production of solid carbide precision cutting tools for die sinking and die making. Where precision and constant radii and angles are required, Dixie solid carbide ball end mills and die sinking cutters maintain their true angle and radius to help eliminate time consuming hand finishing.

Get 10 to 20 times longer tool life with Dixie's exclusive "Micro-Finish" process, and Super-sharp tools required for production of precision dies and molds in today's industry.

DIXIE **SEND FOR OUR NEW CATALOG**

DIXIE TOOL INDUSTRIES
4555 W. FRANKLIN AVE.
BRIDGEPORT, MICHIGAN

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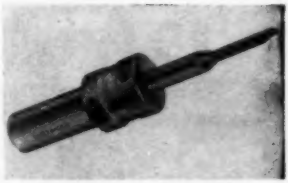
Improves Finish of Bores Up to 1" Dia.

A new line of carbide boring tools meets the need of high surface speed jig boring in small bores, 1/16" to 1" dia. The tools are offered in sets which include We-Bor adjustable holders, or can be furnished separately for any standard boring tool holder. Advantages claimed for the We-Bor boring tool holders are best dynamic balance and high efficiency at high rpm's—needed to achieve high precision and fine finish in small bores with carbide. Neither whip action in holders nor vibration in tools is reported.

Wetmore Tool & Engr. Co., Los Angeles, Calif.



Efficient at high rpm's.

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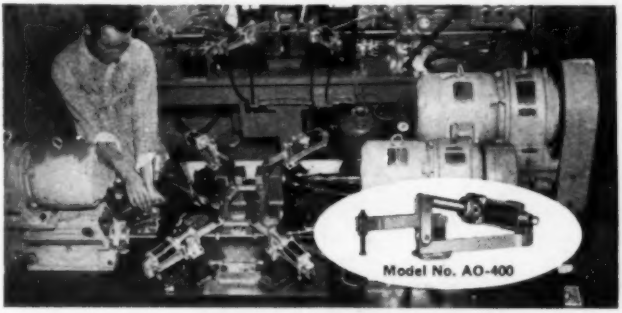

IF PARTS MUST BE HELD

LET KNU-VISE CLAMPS SUPPLY THE MUSCLES

Machining, welding, assembly—wherever parts must be securely held during a manufacturing process—that's where you'll find a lion's share of the work being done by versatile, air-operated Knu-Vise clamps.

Typical of the countless clamping applications handled so successfully throughout American industry by Knu-Vise clamps is the operation illustrated above—the holding of air frame components during drilling operations. These special machines were designed and built by Hewitt and Faust Mfg. Co., El Cajon, California.

If your company has a metal holding application that demands accurate, positive clamping you'll find Lapeer Mfg. Company has a Knu-Vise clamp that will meet your exact needs. Knu-Vise clamps are available in manual, air and oil operated models—are manufactured to give maintenance-free service year-in-and-year-out under the toughest operating conditions.

WRITE TODAY TO DEPT. D FOR COMPLETE INFORMATION

Manufacturers of over 150 models of manually and air-operated clamps and pliers

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except Screw Machine Cams

Design Assistance Offered

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GLOBE Boring Bars and Holders...

Add Hours of Production to Every Shift

Exclusive dual clamping arrangement permits independent adjustment of bar or alignment of holder.
HOLDERS—6 sizes for 8" to 36" lathes
CALIBRATED BARS—12 sizes, 3/8" x 7" to 2½" x 36"

Write for Free Literature

GLOBE TOOLS
3384 S. Robertson Blvd.
Los Angeles 34, Calif.

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Single Station Punch Press For Short Run Piercing

This 15-ton capacity Punch-Master, a new single station punch press for short run piercing of sheet metal, features fast punch and die changing facilities. Holes up to 3½" dia. can be pierced in work up to 24" x 28" in a single handling, it is reported. Any punch and die up to 3½" dia. can be quickly inserted in the press.

Operator can locate work using either the Wiedemann high speed follower

Holes to 3½" dia. pierced in 24" x 28" work.

gauge (pantograph) employing a template, or dimensional stops on a built-in graduated rack for both X and Y coordinates. These positive, mechanical gauges are built into the work table, and can be used separately or in combination, as desired.

Wiedemann Machine Co., King of Prussia, Pa.

Use postpaid card. Circle No. 125

DYKEM STEEL BLUE

Stops Losses making Dies and Templates

Popular package 8-oz. can fitted with Bakelite cap holding soft-hair brush for applying right at bench; metal surface ready for layout in a few minutes. The dark blue background makes the scribed lines show up in sharp relief, prevents metal glare. Increases efficiency and accuracy.

Write for sample on company letterhead

THE DYKEM COMPANY
2301G North 11th St. • St. Louis 6, Mo.

Use postpaid card. Circle No. 377

Unit Converts B&S Screw Machines to Air Chucking

A new Skinner power chucking unit makes it possible to convert Models 2 and 2G Brown & Sharpe automatic screw machines to air chucking. The company states that with this unit it is now possible to chuck cold drawn and odd shaped parts at higher speeds and at less cost. The unit consists of a 4" air chuck with two or three jaws, soft blank work-holding top jaws, a threaded draw bar, a rotating air cylinder, flexible air hose and fittings, a cylinder adapter, and a three-way control valve.

Skinner Chuck Co., New Britain, Conn.

Designed for Models 2 and 2G B&S automatic screw machines.

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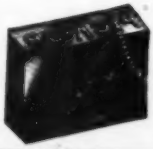
MORE IMPRESSIONS PER DOLLAR WITH "GTS" TOOLS



GTS produces Marking Tools of uniform quality.

Your most rigid requirements will be met with every tool which bears the GTS trademark—whether your need is for one tool or for thousands.

From raw stock to final inspection, these tools are produced in our own plant by skilled craftsmen using the most modern facilities.

Hundreds of standard items can be shipped from stock. A complete inventory of alloy steels permits quick delivery on tools made to order.

Use GTS tools and *you'll know* that there is real economy in buying the best.

IF IT'S WORTH MAKING, IT'S WORTH MARKING

GEO. T. SCHMIDT, INC.
1802 W. BELLE PLAINE AVE.
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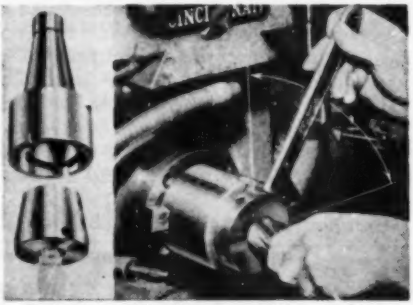
Quick-Change Tool Holder

Claimed to drastically reduce machine tool down-time and re-setting manhours, the new Chi-Cho quick-change solid collet adapter, of finest steel, hardened throughout, is designed to simplify and speed-up production, semi-production, and prototype work, requiring multiple tooling operations.

Consisting of a collet and a collet adapter, the holder is said to provide quick-change, positive locking principles for interchanging tools on any machine in three to five second cycles. It repositions both left and right hand tools within .0005 of indicator settings



Features quick-change, positive locking.

by joining matching high precision internal and external tapers.

The tool holder is universally adaptable to all machine tool spindles and arbors, including Boromatics, turret, automatic, and chucking lathes, Hydrotels and all duplicating heads.

Chi-Cho, Inc., Northfield, Ohio.

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Gears, speed reducers, sprockets, thrust bearings, flexible couplings, pulleys, etc. A complete line is carried in our Chicago stock. Can also quote on special gears of any kind. Send in your blueprints and inquiries.

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Hand lever operation or calibrated feed screw

Vertical mill available

Price complete as above $320.00 (less motor)

LMG Manufactured by NORTHERN ILLINOIS MACHINISTS Crystal Lake Rd. • McHenry, Ill.

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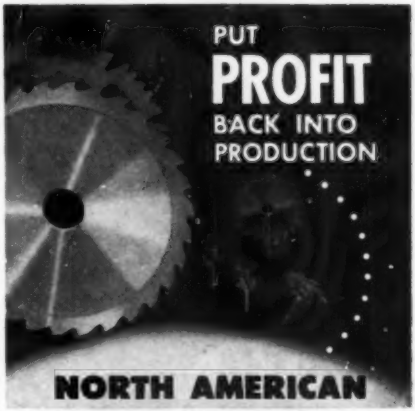

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NORTH AMERICAN PRODUCTS CORP.

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horizontal optical jig borer

offers you increased

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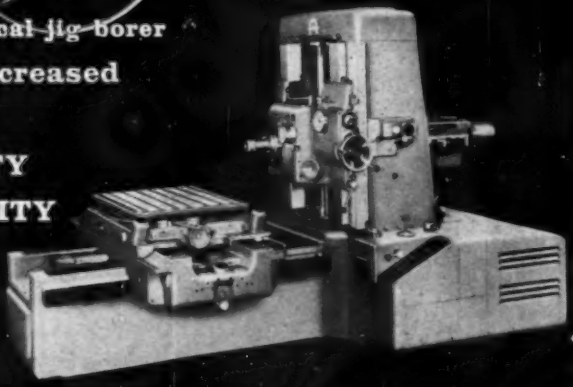

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Measurement in inches

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- Hydraulic feeds and infinitely variable spindle speeds
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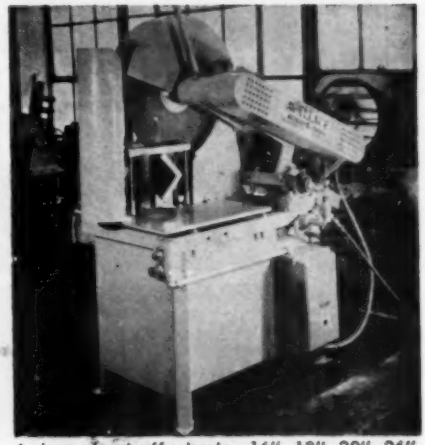
Modular Cut-Machining Units

The new Wallace modular cut-machining units are now available in four sizes of cut-off wheels: 16" - 18" - 20", and for the first time, 26" diameters.

The machine cuts up to 8"x8"x69 lb. wide flange beam, 8" extra heavy pipe. It also cuts 5" round or 4" square solid bars and other sections in proportion.

Wallace Supplies Mfg. Co., Chicago, Illinois.



4 sizes of cut-off wheels—16", 18", 20", 26".

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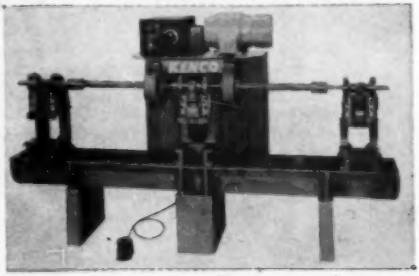
Punch Press For Die Work

A new Kenco Mark III-5E punch press is designed for exceptionally long progressive die work, and also for punching, forming and braking where



Unit consists of three five-ton punch presses mounted on a rugged frame.

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ALL SIZES SINGLE AND DOUBLE END
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extremely long die sets are used. Unit consists of three five-ton punch presses mounted on a rugged frame.

A high torque, high slip motor is used which is connected directly in order to eliminate a clutching mechanism, and permit a central drive. Single tripping is obtained by a cam-actuated limit switch which starts and stops the motor for each punching cycle. The motor is always "dead" during the loading cycle, hence hand feeding in the die area is safe against double tripping.

A selector switch sets the press for various types of operation, including "single trip," "continuous operation," and "inching."

Uses of the press include punching and forming door jambs, window slides, and window frames. In many cases, as many as five operations may be grouped into a single operation.

Kenco Mfg. Co., Los Angeles, Calif.

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LIVE CENTERS

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In the GOLD BAND line Ideal has combined the latest production methods with their traditionally fine craftsmanship to bring you an unequalled standard of excellence in live centers. Accurate, (to ± .0001") GOLD BAND Live Centers offer "custom" quality at production prices. Specify GOLD BAND Live Centers and your every need can be accommodated from stock . . . 99 times out of 100. Ideal's GOLD BAND Live Centers offer savings, simplified operations and higher lathe output both in quantity and quality. Contact your distributor today!

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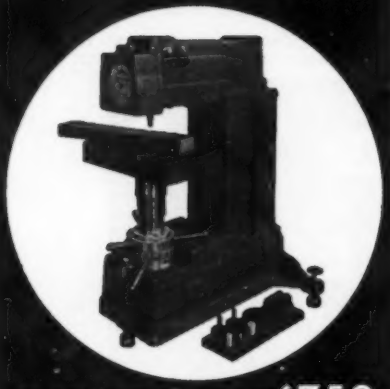
1 Tester



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applied by the inch ounce

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MODEL	CAPACITY
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To know what's new in Barrel Finishing

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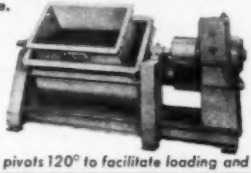
For precise finishing of complex high-quality components on a continuous production line basis. Large parts or clusters of smaller parts are chucked directly to spindles from single operator's work station. Rotating spindles lower parts into high velocity stream of abrasive media contained in rotating tub. All surfaces get same amount of precision finishing in 1 to 9 min. trip around the tub.

Models available with automatic or manual indexing

New ALMCO VIBRASHEEN

New *Vibrasheen* method is particularly suited for faster burr removal and finishing hard-to-reach internal crevices. Vibrates a 5 cu. ft. load . . . uses scrubbing action to do the job in fraction of time needed in ordinary operations. Smaller and larger models also available.



Container pivots 120° to facilitate loading and unloading

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One man operates entire Roll Barrel System. Makes low-cost barrel finish available to any deburring and finishing department!

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Small in size, big in performance . . . that's the new ALMCO *Super Mite!* Ideal for labs, job shops, research departments and manufacturers with limited finishing needs. Handles close tolerance jobs and low micro-inch finishes; speedily does all deburring and finishing work. It's the new answer to low-cost, small-lot barrel finishing!

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Are you waiting weeks for your new high speed cutting tools such as milling cutters, end mills, reamers, drills, counterbores, etc. to be manufactured? You can eliminate these bottlenecks in your plant by contacting us, Chicago's cutting tool specialists since 1919, for fast service. Our facilities allow us to modify or change most of our stock catalog tools into specials practically overnight and ship to you with a minimum of waiting time. Try us once and be convinced. Send prints or sketches for immediate quotation. Phone or wire us in an emergency. Orders processed at once. Send for free colorful brochure.

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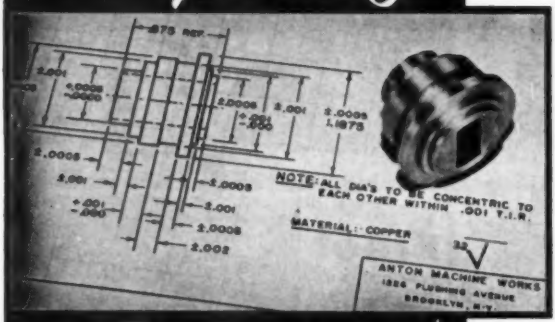

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A fully responsible source with unusual facilities for turning, milling of small intricate parts, and enviable performance record in this highly specialized field.

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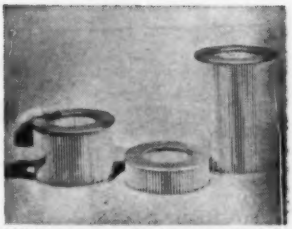
Reservoir Filter Replacement Elements

The new 6236 Series of reservoir filter replacement elements, in three sizes of four different filter media with micron ratings from 2 to 100, is designed to protect cylinders, pumps, valves, etc. The three sizes have an outside dia. of 6" with lengths of 2", 4" and 8". The series offers a wide range of micron ratings in four different media: Micropleat (5 to 40 microns), Micromesh (5 to 100 microns), and Microbon (40 microns).

Bendix Filter Div., Bendix Aviation Corp., Madison Heights, Michigan.



Wide range of sizes, materials and ratings.

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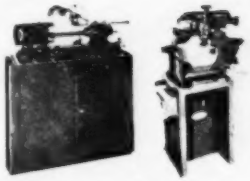
As the pictures show, taps cost roughly 6 times as much as drills. Yet it's common practice to resharpen the drill — and throw away the tap.

It doesn't make sense. And it's an awful waste of money.

That's where Blake comes in.

Blake makes low cost, high-precision tap grinding equipment. These easy operating tools can make your taps last up to 6 times longer . . . reduce work spoilage . . . enable taps to cut more accurately and uniformly with less strain . . . cut tap costs as much as 65%.

It's surprising how many people overlook this proven, basic method of saving money. Be sure you don't. Ask us for complete information.



Blake Chamfer Grinder/Blake Flute Grinder used in combination, create or restore:

1. exact indexing of cutting edges.
2. controlled rake angles for each job.
3. correctly ground spiral points.
4. perfectly relieved chamfers . . . make one tap do work of six!

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Hand Finishing Bottlenecks with Portable Electric Reciprocating Tools

These handy tools will cut out many tedious hand filing and finishing operations—Increase Production—Produce Uniform Work.

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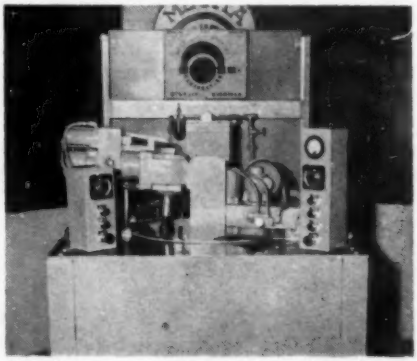
Deburring and Finishing Unit Has Two Spindle Heads

The Mechamatic MM-2 high speed Model No. 3000, two spindle unit, has been designed for low production of a multiplicity of parts and/or high production of a single component. The advantages of having two independently operated spindle heads is that the machine operator can service one while



One head can be serviced, while other is operating.

the other is operating. Also, the finishing process is completely automatic except for loading and unloading the parts.

At a 15-second time cycle, it is reported the machine as illustrated will produce 240 pieces per hour at 100% efficiency, with a capacity up to 6" dia. piece part.

Mecha-Finish Corp., Sturgis, Mich.

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The manufacturer, Set Screw and Manufacturing Co., states that change-over from manual to automatic insertion of set screws has been made easier and more profitable with the new Setko compact hopper feeder.

The vibrator and the air-operated

Vibrator and driving mechanism have been reduced in size.

driving mechanism have been reduced in size, yet have gained in efficiency. All of the components are more accessible and the wiring and controls have been simplified.

Set Screw and Manufacturing Co., Bartlett, Ill.

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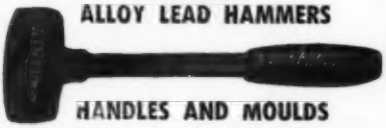
ALLOY LEAD HAMMERS



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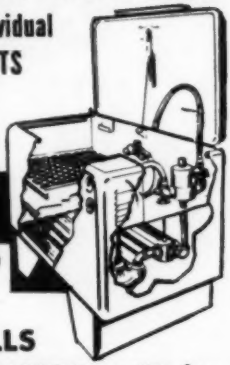

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2. Flush chips and dirt from metal parts with filtered solvent
3. Clean out blind holes and cavities
4. Do it thoroughly, fast and safely

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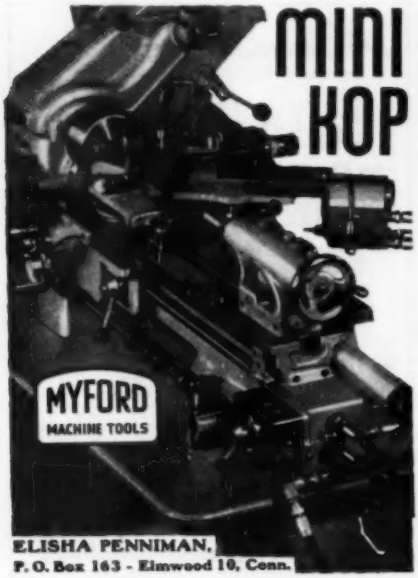

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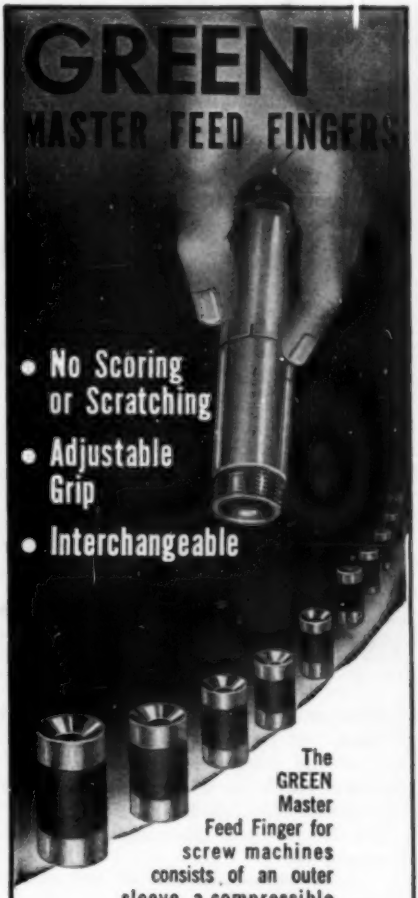

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85	97	109	121	133	145	157	169	181	193
86	98	110	122	134	146	158	170	182	194
87	99	111	123	135	147	159	171	183	195
88	100	112	124	136	148	160	172	184	196
89	101	113	125	137	149	161	173	185	197
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204	229	254	279	304	329	354	379	404	429	454	479	504	529	554	579
205	230	255	280	305	330	355	380	405	430	455	480	505	530	555	580
206	231	256	281	306	331	356	381	406	431	456	481	506	531	556	581
207	232	257	282	307	332	357	382	407	432	457	482	507	532	557	582
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211	236	261	286	311	336	361	386	411	436	461	486	511	536	561	586
212	237	262	287	312	337	362	387	412	437	462	487	512	537	562	587
213	238	263	288	313	338	363	388	413	438	463	488	513	538	563	588
214	239	264	289	314	339	364	389	414	439	464	489	514	539	564	589
215	240	265	290	315	340	365	390	415	440	465	490	515	540	565	590
216	241	266	291	316	341	366	391	416	441	466	491	516	541	566	591
217	242	267	292	317	342	367	392	417	442	467	492	517	542	567	592
218	243	268	293	318	343	368	393	418	443	468	493	518	543	568	593
219	244	269	294	319	344	369	394	419	444	469	494	519	544	569	594
220	245	270	295	320	345	370	395	420	445	470	495	520	545	570	595
221	246	271	296	321	346	371	396	421	446	471	496	521	546	571	596
222	247	272	297	322	347	372	397	422	447	472	497	522	547	572	597
223	248	273	298	323	348	373	398	423	448	473	498	523	548	573	598
224	249	274	299	324	349	374	399	424	449	474	499	524	549	574	599
225	250	275	300	325	350	375	400	425	450	475	500	525	550	575	600

Inside Front Cover Inserts: 1A 1B 1C 1D — **Inside Back Cover** 2A 2B 2C 2D — **Back Cover** 3A 3B 3C 3D

Company .....

Name ..... Position.....

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City ..... Zone..... State.....

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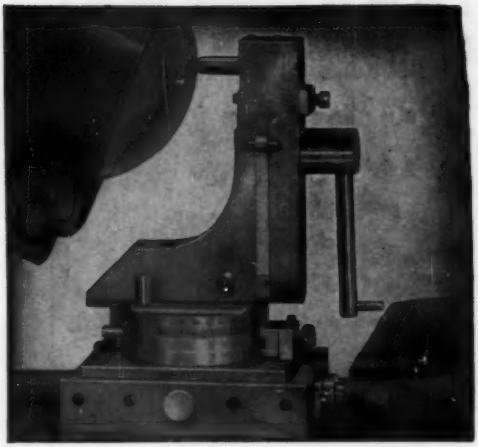
Tough Grinding Wheel Forms Dressed Easy as A, B, C

eliminate elaborate set-ups and operations

.0001" ACCURACY

Fluidmotion
WHEEL DRESSERS
dress two angles tangent to a radius in one continuous motion



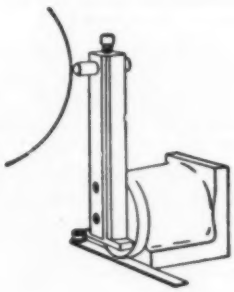
With the unique "Fluidmotion" Dresser, you can dress two angles tangent to a radius — using one handle in one continuous motion. Operation is so fast and simple that beginners can use them.

Adaptable to all type cylindrical and surface grinders.

A. Obtain micrometer reading; add required convex radius or subtract required concave radius.

B. Loosen jib with wrench and "mike" over lower pins to reading obtained above.

C. Tighten jib. Set stops for two angles. Ready for action.



Also available: "FORM MASTER" Dresser, capable of dressing any radii up to 12" convex, up to 15" concave.

See your industrial distributor or write for free literature.

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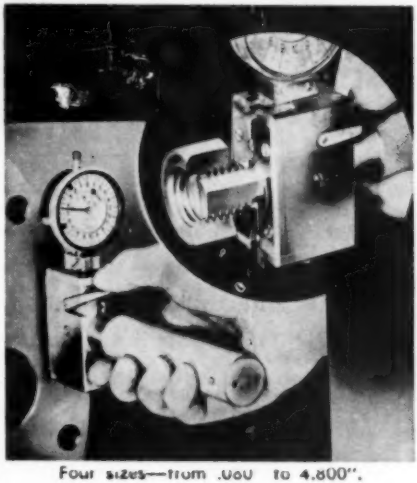
Accurate High Speed Thread Checking Instrument

A dial thread plug gage is said to speed up the inspection of internal threads and will perform the Go and No-Go inspection in one operation.

The instrument employs three measuring jaws representing master thread gages, one of which is retractible between the other two, so jaws can be inserted into the thread without any threading in and out. The measuring



Four sizes—from .080" to 4.800".

jaws expand under spring action and engage the thread along its entire length. After setting the indicator to zero with a ring gage, the instrument is inserted and the measurement of the inspected female thread may be read on the dial and its tolerance position noted.

The gage can also be adapted for measuring cylindrical bores. Measuring blades with spherical faces are available for measuring smooth bores or minor diameters of nuts.

Four sizes cover a range from .080" to 4.800".

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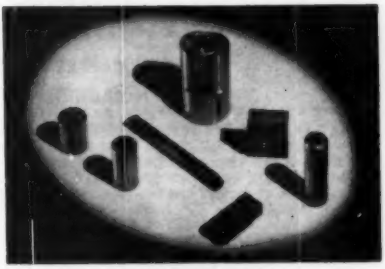

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GIVES YOU LONGER DIE LIFE ON

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HI-PRODUCTION
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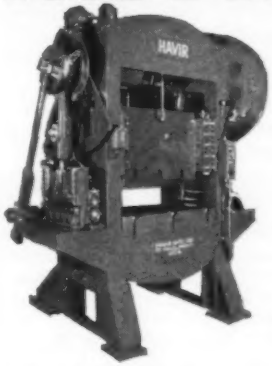
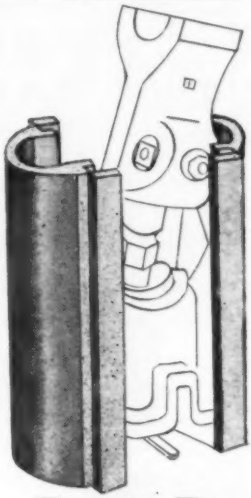


COSTLY CARBIDE DIES WEAR LONGER

because extra bearing area supporting ram from every angle provides more rigidity and precision than conventional vee ways. HAVIR (formerly Diebel) Presses also have extra crankshaft bearing area to reduce crank deflection. Cut your costs by reducing down time, adding die life with HAVIR Hi-Production Automatic Presses.

HAVIR 200 TON
Other models from 5 Ton



MORE BEARING FROM EVERY ANGLE

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Sales Service Mfg. Co.

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Ask your HAVIR Distributor for details or write direct.

For O.B.I. Presses investigate PRESS-RITE. 2 Ton to 85 Ton.

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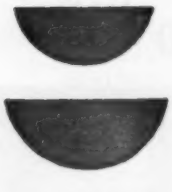

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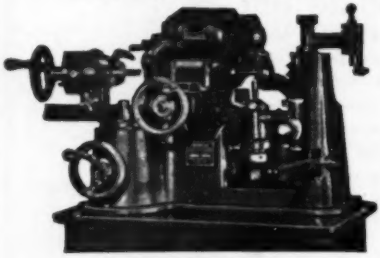

Model 1100

- Capacities No. 0 Machine Screw to 2½" Hand Taps

HENRY P. BOGGIS COMPANY
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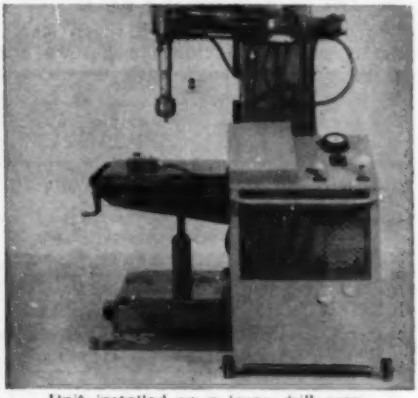
Self-Contained Hydraulic Feeds Automate Heavy Duty Presses

Completely self-contained hydraulic drill press feeds automate older type, large drill presses, having capacities up to approx. 1½" in steel, for high production drilling and allied work. The unit consists of a heavy-duty power transmission arm and a portable console on wheels, which houses



Unit installed on a large drill press.

control valves and hydraulic tank and pump.

The Beckett Hi-Cyclic hydraulic solenoid valve control system used provides a completely variable and quickly adjustable approach speed, slow-down for work entry, return speed, and working thrust.

Two general sizes are available.

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Here It Is . . . The One Universal Compound Angle Vise Which Really Covers All Angles!

You've wished you could have a universal holding fixture which could present any face at any angle and hold it without chatter while you grind tools. And a vise that can make radius on the end of tools! And a vise that blends compounds with clearance on one side differing from the clearance on the other! And a vise that can be set up to grind the side and end at the same time as you make radius. Here is a vise that will do just those kinds of jobs and do them better than you ever dreamed. In one setup, you can obtain precision holding in a matter of seconds to grind side angles, side rakes, back rakes, or any compound you need without use of angle parallels. Five independent movements allow accurate positioning of any face to any angle.

Write today for information on how this universal compound angle vise will make every radius grinding job simple, more accurate, and faster than any other method you have tried.

COMBINATION VISE & JIG CO., INC.

ORFORDVILLE, WISCONSIN

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TIME SAVERS for the Tool Room

. . . and the production line

Do It Faster With A DREMEL MOTO-TOOL

For top-speed, top-precision grinding, polishing, and burring, low-cost Dremel Moto-Tools are your best practical buy. Use them in tool and die work, pattern making, burring operations, and dozens of other applications. They're light and easy to handle. Give you quick access to areas inaccessible for larger grinders. Cool-running universal motor develops 27,000 R.P.M. Smooth operation permits precision accuracy in close-tolerance work, eliminating costly and painstaking hand work.

Model No. 2 Moto-Tool only $19.95

Model No. 2 Moto-Tool Kit, with 23 accessories, including high-speed cutters, in steel storage case $27.50

See Your Industrial Supply Dealer or Write to

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Drives Insure Performance Accurate Indexing

Standard Geneva Drives are available with 3 to 24 indexing stations for shaft center distances from 3" to 6" in ¼" increments. A wide variety of hub and bore diameters is offered. Steel wheels are furnished with Meehanite driving wheels.

The new drives answer the demands of high speed automation in industry and are said to incorporate precise design and manufacturing techniques to insure performance, accurate indexing, positive locking, and smooth, trouble-free operation.

Center distances less than, intermediate, or greater than the standard 3"-6" ranges are available upon request. Special assistance can be provided in the design of other Genevamatic Drives.

Genevamatic Engineering Corp., Tampa, Florida.

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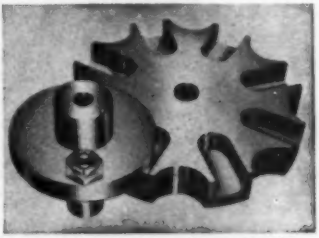

For shaft center distances from 3"-6" in ¼" increments.

JIG GRINDING and JIG BORING

to your specification

At your disposal: Our sub-contract jig boring department, one of the best equipped in the East.

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FULLY JEWELED & SHOCKPROOF MOVEMENT

LARGE VARIETY OF CONTACT TIPS AVAILABLE FROM STOCK

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IN PLASTIC CASE WITH CABLE RELEASE

THE MAUSER INDICATOR IS ALSO AVAILABLE GRADUATED FOR DIRECT READING .0005" WITH .016" FULL RANGE OF DIAL. Cat. #657 — ONLY $16.00

MAUSER INDICATOR STAND

- 2-½" DIA. HARDENED GROUND & LAPPED TABLE
- 6" VERTICAL CAPACITY
- FINE ADJUSTMENT OF VERTICAL CAPACITY BY MEANS OF KNURLED RING WITH INSTANT LOCKING
- WILL ACCOMMODATE ALL INDICATORS WITH 8mm. SHANK

Cat. #6131F

ONLY $29.75

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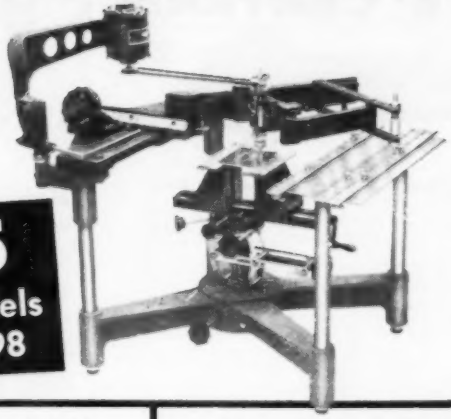

$575
other models from $298

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Dovetailed, rigid for continuous, accurate production.

★ **LARGE ENGRAVING AREA**
Covers 12" x 3½" in one setup.

★ **HEAVY DUTY SPINDLE**
Cuts ⅛" deep in brass, 1/16" in cold rolled steel, in one pass.

★ **2 DEPTH REGULATORS**
Uniform depth of cut guaranteed, even on uneven surfaces.

★ **UNIVERSAL HOLDING VISE**
Cuts setup time in half.

MACHINE TOOL OF 1001 USES:
marking parts, tools, bins, engraving nameplates, stencils, instrument panels, dials, etc. Profiling, slotting, milling and other jobs, eliminating several setups, costly equipment, and skilled labor.

all with unskilled labor because it's tracer-guided

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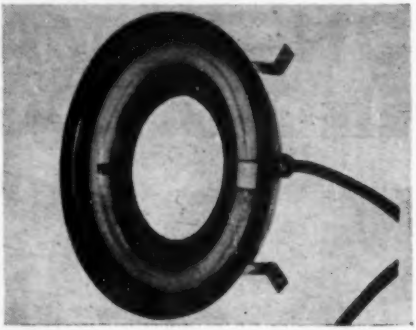
Boring Mill Light

The standard Boring Mill Lite provides maximum visibility with light directed right into the hole on boring mills, drill presses, etc. The reflector directs full light into the hole, without any shadows.

Metal brackets permit speedy installation around the work spindle. Lightweight aluminum housing makes the unit corrosion free. Maximum operator safety is assured by low voltage operation—on any standard 110-120 volt, 60 cycle supply.



Model 12, with 12" circline fluorescent bulb, 32 watts, is priced at $49.75; Model 16, with 16" circline fluorescent bulb, 40 watts, is $59.75.

Standard Boring Mill Lite Co., Detroit.

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LIVE CENTERS

LIVE CENTERS

Head No.	Morse Taper	Price
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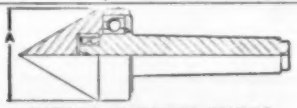
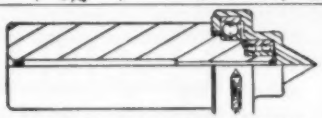
3	3	32.50
4	4	40.00
5	5	52.00
6	6	75.00
7	7	265.00



TUBING CENTER SPECS.

Hd. No.	"A"	Morse Taper	Price
2	1⅞"	2	$32.00
3	2⅛"	3	40.00
4	2¼"	4	43.00
5	3¼"	5	57.00



STRAIGHT SHANK CENTERS

Hd. No.	Shank Size	Price
3	1"	$40.00
4	1½"	53.00
5	1¾"	65.00
5	2"	75.00
6	2½"	85.00

Head of any other size and shape can be furnished to specs. Standard shanks made with Morse tapers, other tapers special, always specify Head and Taper—4 page catalog on request.

STURDIMATIC TOOL COMPANY
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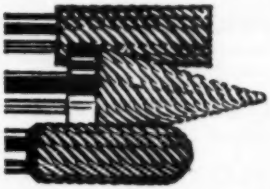

- ★ Ground Cut Rotary Files for Soft Metals.
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- ★ Salvage and Regrinding Service.
- ★ Dealers Inquiries Invited.

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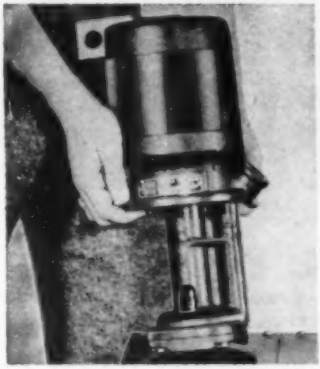
¼ H.P. Coolant Pump Provides Big Performance in Small Space

A more compact double suction coolant pump has been added to Graymills new H-7000 series. This unit, operating at 3450 rpm, is said to pump all types of coolant and even liquids with viscosities up to 10,000 ssu. The built-in mounting flange and discharge feature simplifies installation.



Offered in two immersion depths 6" or 8½".

Pump is available in two immersion depths of 6" or 8½".

Graymills Corp., Chicago, Ill.

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Steel Cabinets for Jig Borer & Grinder Tools

The numerous valuable gages, fixtures, special tools, etc. used with jig borers and jig grinders all have a place in new steel cabinets specially engineered for the purpose by Vidmar, Inc. These cabinets, supplied in two models—one for jig borer accessories, the other for jig grinder accessories—keep everything at the machine operator's finger-tips.

A large, durable plastic work surface for drawings measures 29½" x 60". Height of cabinet: 31½". Drawer comfortably supports 300 lb. rotary table.

Vidmar, Inc., Williamsport, Pa.

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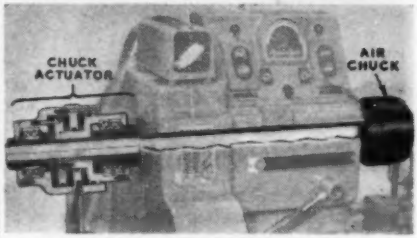
Revolutionary New Chuck and Actuator!



Safe, proven Gamet Air Chuck and Powergrip Chuck Actuator installs easily on your lathe. Saves money—gets results. Makes it possible for you to:

- Use lathe for both bar and chucking work.
- Use the draw tube hole for coolant, or tools.
- Eliminate air leaks and reduce flywheel effect.

Guaranteed for One Year. Chuck Size 4¼" to 14".

POWER GRIP, INC.
ROCKFALL, CONN.

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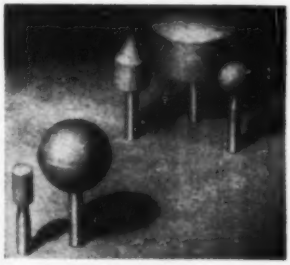

ABRASIVE WHEELS AND POINTS

on ⅛" steel mandrel
Any assortment and grit wanted

WE SELL THE BEST FOR LESS

ANTARES INSTRUMENTS INC.
55-02 37th AVE. WOODSIDE 77, N.Y.

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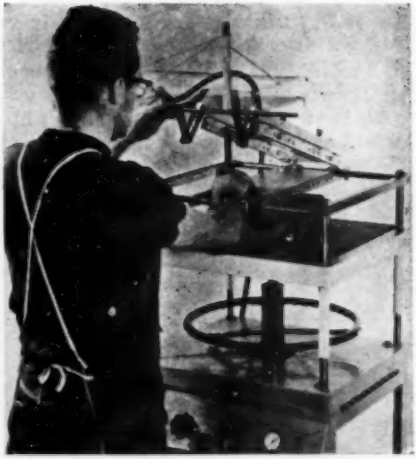
Plastic Press Has Built-In Heating Unit

New Di-Acro plastic press Model 18A, said to perform three-dimensional forming operations in thermoplastic sheet materials up to 18" square, uses the principles of mechanical stretch forming, vacuum forming and blow forming. The machine is useful in both the experimental shop and on short run production. Besides forming parts from thermoplastic sheet materials such as polystyrene, vinyls, butyrates and acrylics, it was also pointed out that skin packaging or blister packaging operations can be performed on the machine.



Hinged clamp frame provides for easy inserting and removing of sheet plastic.

A pivot-mounted radiant heater panel, with max. heat temperature of 660° F., provides a short heat cycle on sheets.

Hinged clamp frame, which speeds inserting and removing plastic material, accommodates 180 different sizes. It adjusts for thicknesses through ¼", widths, 6", 9", 12", and 18", lengths, 4" to 18" in increments of 1".

O'Neil-Irwin Mfg. Co., Lake City, Minn.

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- Special tools to specifications
- Distributor inquiries invited about better profit margins with RICO TOOLS.

Attach ad to your letterhead for more information.

RICO

RICO TOOL CO.

5915 DIXIE HWY. • SAGINAW, MICH.

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CLOSED Plain Type

AUTOM TRADE MARK

CLOSED Offset Type

CONTINUOUS HINGES

OPEN

All hinges shown can be furnished with special holes, cutouts and bends to blue-print in metals to suit the job.

THREE-FOURTHS OFFSET

AUTO MOULDING & MFG. CO.
1110 E. 87TH ST.
CHICAGO 19, ILL.

SPECIFICATIONS
Open width 7/8" to 6"
Gage Material .040 to .125
Pin Diameter .101 to 3/8
Lengths to 120"

OPEN

SEMI-OFFSET

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Compound For Lapping Carbide

Tetrabor Paste is a ready-to-use compound of special oils and boron carbide specifically prepared for lapping carbide and performing other difficult polishing and lapping operations, without the use of expensive diamond compounds. It closely resembles diamond in hardness and specific weight and has pressure resistance equivalent to diamond. The compound is available in 100 gram tubes from 100 to 1,200 grit. Sample kits containing five gram samples of 12 different grits cost $15.50 each.

Titan Tool Supply Co., Inc., Buffalo, N.Y.

Performs difficult polishing and lapping operations.

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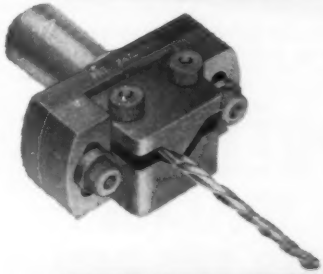
ACCURATE SET-UPS FAST!



Accurate, rapid set-ups the first time, every time . . . is the reason Brookfield Tool Holders are now widely used in practically every metalworking plant in the country. With one Brookfield Tool Holder, you can cut your stock of bushings by at least 100. Here's why:

BROOKFIELD TOOL HOLDERS

ADJUSTABLE V JAW holds wide range of tool diameters without bushings or accessories.

AXIALLY TRUE DESIGN makes perfect tool alignment almost automatic.

BALANCED-PRESSURE LOCKING ASSEMBLY maintains uniform seating, eliminates creep or shift.

EASY TO USE — just slip tool in the jaw, tighten, then float tool into dead center and lock.

AVAILABLE IN A WIDE RANGE OF SIZES

MODEL NO.	HOLDING RANGE	SHANK DIA.
BA-10	1/64"–3/16"	5/8"
DA-10	1/64"–1/2"	5/8"
DA-12	1/64"–1/2"	3/4"
GA-12	1/16"–3/4"	3/4"
GA-16	1/16"–3/4"	1"
KA-16	1/8"–1"	1"
KA-24	1/8"–1"	1 1/2"
PA-24	1/4"–1 1/2"	1 1/2"
PA-28	1/4"–1 3/4"	1 3/4"

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BROOKFIELD, INCORPORATED

STOUGHTON 112, MASSACHUSETTS

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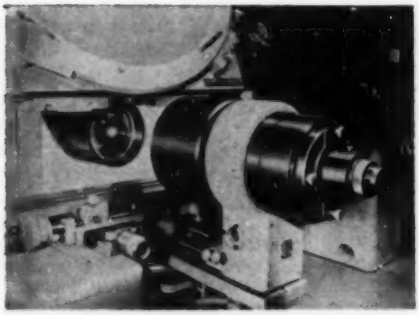

New 6" Lens System For Optical Comparator

A new J & L 5-magifications lens system with a 6" aperture is said to be free from measurable distortion and useful in applications which require precise measurement of large areas. It is also reported to permit great latitude of use because of extremely sharp definition and freedom from distortion.

Optical Comparator Div. of Jones & Lamson Machine Co., Springfield, Vt.

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Universal Right Angle Irons made to unusually high standards for squareness and parallelism. Heights from 5" to 16".

Toolmaker's Knee has all finished surfaces ground square and/or parallel to each other within .0001".

Standard and heavy duty precision V-Blocks with workholding capacities from 1¾" to 6⅜" diameter.

Universal Squares feature precision lapped knife edges, square to within .00015" or better.

Sine Bars are made with overall accuracy in tenths and finer. Scientifically heat treated and precision ground. In 3", 5", 10" and 20" sizes.

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TOOLS FOR MASTER TOOLMAKERS

Taft-Peirce Production and Inspection Equipment gives the Master Toolmaker the one vital ingredient essential to his craftsmanship: "ACCURACY HE CAN TRUST."

You can buy and use Taft-Peirce tools with confidence, and rely on published manufacturing tolerances and job-tested design.

SEND FOR NEW PRODUCTION AND INSPECTION EQUIPMENT CATALOG NO. 511. AND SPECIFY TRUE PRECISION TOOLS BY TAFT-PEIRCE FOR YOUR TOOL ROOM.

TAFT-PEIRCE

TP 9-19

7 Mechanic Ave.
WOONSOCKET, RHODE ISLAND

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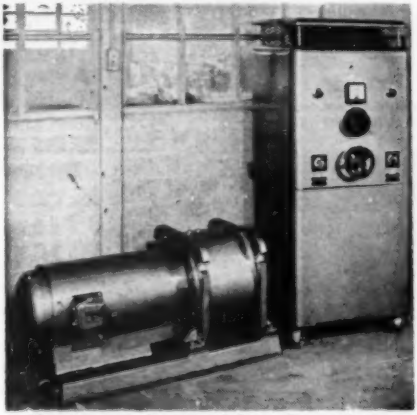
High-Speed Die Sinking Method

Rapid sinking of die cavities and odd-shaped holes in any metal is claimed to be provided by a new cutting method. This is a two-step process, consisting of (1) high-speed roughing with a spark-erosion machine tool using a newly-developed power supply called the Sparcatron R.I.G., and (2) finishing on the same machine, using the machine's normal spark-cutting power supply to obtain final size and finish. Any precision spark-erosion machine may be used, with an electrode of aluminum, Zamak alloy, copper or brass made to the shape of the hole or cavity.

On the roughing cut, metal-removal rates of 6 cubic inches per hour or more are reported. Radii, fillets and complex shapes are reproduced, with less than 1/32" finishing.



Metal removal rates of 6 cu. ft. per hour.

The Sparcatron R.I.G. consists of a rotary impulse generator and control cabinet. Four power settings are provided, with a maximum output of 250 amps at 25 volts. Power requirement is 12.3 kva, 220/440 v., 3-phase 60-cycle.

Easco Products, Inc., Ypsilanti, Mich.

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FLUID POWER

"a young industry with a great future"

HOME STUDY COURSE

- **Installation**
- **Operation**
- **Maintenance**

An opportunity to learn Theory, Fundamentals of Operation, Application, Diagnosis and Repair of all types of Hydraulic and Pneumatic equipment, and controls.

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TRAINING for INDUSTRY DIVISION

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Guaranteed accuracy 0.001"

Model 50DCS
Dull Chrome Finish on
Stainless Steel

SPECIAL OFFER . . . $12.80 with Leather Case

Easier Reading with Double Vernier
No Strain from Glare with Dull Chrome Finish

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PRECISION MEASURING

Helios

NEISE MODERNTOOLS

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SUPER COMPARATOR Gaging Head by Mahr

Reading in 20 MILLIONTHS of an inch

ACCURACY over entire range ± 10 MILLIONTHS
RANGE of dial ± .001"
SPACE between graduation lines .0354"

. . . with these SPECIAL ADVANTAGES

- CONSTANT MEASURING PRESSURE and practically frictionless movements of all parts
- EXTREME MEASURING ACCURACY and MAXIMUM SENSITIVITY
- SHOCKPROOF MOVEMENT fully JEWELLED
- FINE ADJUSTMENT over entire dial range
- CABLE RELEASE for lifting of feeler point
- SAPPHIRE TIPPED contact point

NON-GLARING Dial and hair thin Pointer

Adjustable Tolerance Hands

Instant Fine Adjustment

SUPER ACCURATE
The measuring pressure is 100 grams making this comparator most sensitive and accurate.

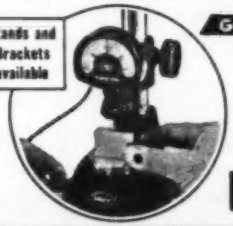
PRICE $59.50 with plastic case

Fully jewelled shockproof movement

Small in size for limited working space

Overall dimensions 3-3/4" x 2-1/2" x 3/4" thick

Stands and Brackets available



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OTHER COMPARATORS with .000050" and .0005" Graduations

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HEADQUARTERS FOR PRECISION MEASURING INSTRUMENTS AND FINE TOOLS

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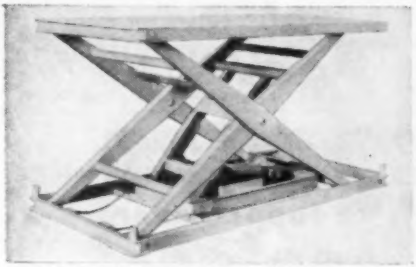
Hydraulic-Powered Lift Tables

A new LP Series of scissor-type, hydraulic-powered lift tables simplifies lifting, feeding and work-positioning of long loads for machine, process or assembly operations.

Models range in capacity from 1,000



LP-3 lift table with 3,000 lb. cap.

to 6,000 lb.; platforms from 38" minimum width to 65" maximum width; from 7'0" minimum length to 16'0" maximum length.

Southworth Machine Co., Portland, Me.

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New Ideas in Cutters

★ Designers and manufacturers of H. S. S., tantung, and carbide cutters based on cost saving principles. Form relieved, hard faced cutting edges, throwaway inserts, welded bodies, semi-finished blanks, clamped-on blades. Serving America's metal working, carbon, graphite, valve, and instrument manufacturers. **Write or phone LUdlow 8400 for latest catalog.**

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Division of Bollier-Damerell, Inc.
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ALL ALLOY FULLY GUARANTEED

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PORTABLE

No. 1 cuts up to No. 11 gauge strip or sheet.
No. 2 cuts up to ¼" steel plate.

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the original, patented spring loaded live centers

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GREATER LOAD CAPACITY

LESS OVERHANG MEANS MORE RIGIDITY... MORE WORKING RANGE

AUTOMATIC THRUST ADJUSTMENT
Spring loaded spindle maintains constant tail stock thrust.

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Needle bearing distributes bearing stress over greater surface, thus holding close tolerances for much longer time.

FASTER SPEEDS
Smaller turning radius gives much higher RPM rate than ordinary live centers.

Pat No. 2,520,473

Write Today for Complete Information

CONCENTRIC TOOL CORP., 2486 Huntington Dr., San Marino, Calif

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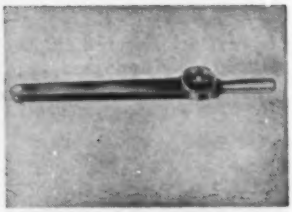
Lightweight Rigid Frame Torque Tool

An improved rigid frame dial indicator type torque tool, for the automotive, industrial, electrical and assembly fields, is ideal for close-quarter tightening. Only ⅜" of rotary travel, left or right, is said to exert a full 30 in.lb. of torque. This 8" RDI-30 model has graduations reported as balanced 30—0—30 in.lb., with minimum graduation equal to 1 in.lb. A snap button on the back of the frame provides for easy calibration check and resetting when needed.

Apco Mossberg Co., Attleboro, Mass.



Built for rugged duty.

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Another Tapmatic Success Story!

"We've tapped over

2,000,000

HOLES without any service or repairs on our new

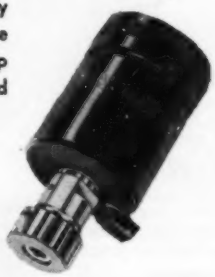
TAPMATIC ATTACHMENT!"

William W. Wachtel, General Manager, Jonathan Mfg. Co., Fullerton, Calif.

"We feel that this tapping attachment is an important factor in the production of the Chassis Slide Rails we manufacture for the electronic, aircraft and missile industries. Components are tapped with #4-40, #8-32 and ¼" — 20 taps . . . . . .

AT SPEEDS UP TO 2200 RPM."

"Our Tapmatic Attachments consistently produce excellent quality threads in the aircraft quality aluminum that we use. Tap breakage has virtually been eliminated even though many of these holes are bottom tapped holes."



TAPMATIC TAPPING ATTACHMENTS, with capacities from #00 to 1" are the modern solution to your tapping problems. A complete line of attachments are available for both reversing and non-reversing spindles.

TAPMATIC CORPORATION

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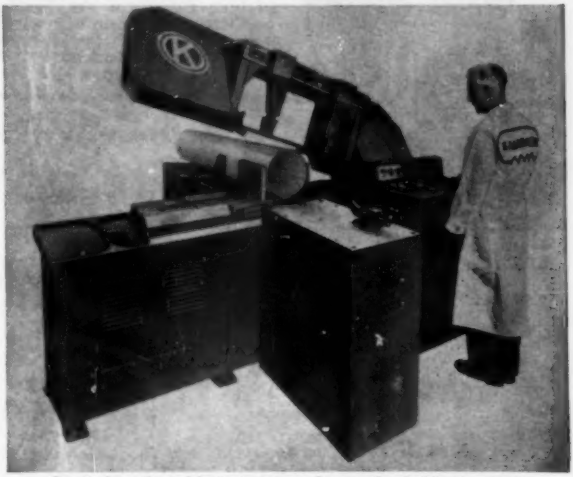
Heavy Duty Band Saw Offers Large 14" x 24" Rectangular Capacity

A completely hydraulic, heavy duty band saw has been added to Kalamazoo Tank & Silo Co.'s line of horizontal band saw machines. The "Big K" Model 14A is said to offer cutting capacity and ability in excess of any cut-off method, at far less tool cost per square inch of cutting.



Controls adjust blade tension, frame feed, blade speed.

A number of new developments include a hydraulically driven blade reported to instantly and automatically vary torque with changes in cutting conditions; clockwise blade rotation to reduce tooth shock when entering the workpiece; positive cutting pressure maintained at a selected constant rate, and a convenient 36" machine height to reduce operator fatigue. A large 14" x 24" rectangular capacity is provided.

To permit quick adjustment of blade tension, frame feed, and blade speed, all controls are grouped at a central control console, located for operator safety.

Machine Tool Div., Kalamazoo Tank & Silo Co., Kalamazoo, Mich.

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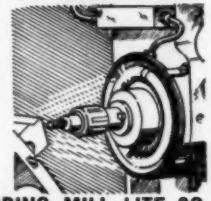
"Donut"-type fluorescent fixtures direct light into work without heat, shadows, obstruction. Wide application . . . easy installation . . . free literature.

CIRCLELITE



STANDARD BORING MILL LITE CO.
6771 E. McNichols • DETROIT 12, MICH.

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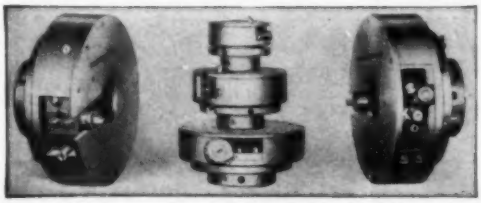

MUMMERT-DIXON
FACING HEADS
with Automatic Feed

One-way Tool Feed—6, 9 and 12" sizes.
Two-way Tool Feed—9, 12, 16, 20, 24, 30, 36, 40 and 46" sizes.
Save many costly set-ups.
Bulletin No. 4141 Gives Full Details

MUMMERT-DIXON CO., 122 Philadelphia St., Hanover, Pa.

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Advertisements acceptable in THE MARKET PLACE include those for employment, sales services, production facilities, representation and related needs. **Rates: $20 per column inch per insertion. Maximum size advertisement accepted in this section is three inches.**

Copy should reach us by the first of the month for next month's issue.

MACHINE and TOOL BLUE BOOK **A Hitchcock Publication** **Wheaton, Ill.**

.0003 Hole Location in One Minute
Thousands of companies and individuals have proven and accepted our EDGE FINDERS for years. Ask for literature with users list and dealers in your area. Hardened and ground on all surfaces including contours for balance. .500" size $2.50. Deluxe .200" size $10.00. Vise stop for holding same hole location in several pieces $2.95.

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ACETATE SHEETS
UP TO ¼" THICK
Sheet sizes
20" x 50"
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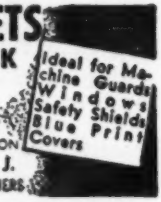
201 S. Dean St., Englewood, N. J.
formerly INDUSTRIAL PRODUCTS SUPPLIERS



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Holder & Brush Complete $1.65
Refills only 65 cents
Any Quantity Order from this Ad
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HOWELL DEVICE COMPANY
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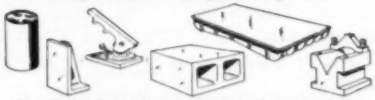
Precision surfaces, after extended usage, get worn, lose original accuracy. Let Machine Products . . . a leading manufacturer of precision surfaces . . . recondition them. For a prompt quotation specify type item, size, material, surface finish (ground or scraped) required.



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6771 E. McNichols • DETROIT 12, MICH.
Phone TW 1-4154

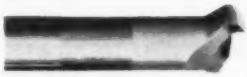
"Do I know anything about them? I have three at home and one on the way."

REPRINTS AVAILABLE

Reducing Production Cost With Pneumatic Devices
Electro-Chemical Machining
Endless Belt Feeding to a Progressive Die
More from your High Production Machines by Harry Conn

MACHINE & TOOL BLUE BOOK
Hitchcock Publishing Co.
Wheaton, Illinois

BOKUM makes a STANDARD BORING TOOL for EVERY job



STYLE A
for general boring

STYLE B
for bottoming and facing

STYLE C
for internal threading

You name the job—and regardless of whether or not it is general boring internal threading, internal chamfering or cutting O-ring grooves—you'll find that Bokum has a boring tool that is standard for that particular operation.

You'll find, too, that Bokum boring and internal threading tools are designed for top accuracy—all cutting and clearance angles (figured by mathematical formula) are designed for the job they are to do. The result is boring tools that give production performance with tool room accuracy throughout their long life.

Bokum boring tools are available in super high speed steel, carbide tipped or solid tungsten carbide. Next time you order—specify Bokum—get maximum accuracy and economy from the same tool.

THREAD RECESSING—TR-3
insure perfect threads in blind holes

BACK CHAMFERING—B-CH-3
for clean cut-offs without burrs

O-RING GROOVES—OR-103
15 stock sizes available

RETAINING RING GROOVES—RR-SV-46
29 stock sizes available

TRADE MARK REG. U.S. PAT. OFF.

BOKUM TOOL CO. INC.
14775 Wildemere Ave., Detroit 38, Michigan

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17 don't overlook these features

- **Stiction,** sometimes called "stick-slip," is thoroughly explained by Harry Conn: what it is, how it occurs in way movements. **Page 75**
- **Tool Cost Estimate**—Introducing Allan Young, who takes over the "Process Engineering" department with valuable hints on how to prepare and present the important tool cost estimate. **Page 83**
- **Tapered Steel Shells** from low carbon 0.125" sheets posed several problems for an English firm, because the need for urgency necessitated the purchase of stock material from several sources. **Page 99**
- **Handling a "Slowdown"**—The Personnel Manager offers to play the part of a "heavy" in a little drama entitled: "How We Doubled Production in a New Department without the Help of Industrial Manager or Consultants." **Page 106**
- **Facing with Ceramics.** Early tests with ceramic tools on facing operations were discouraging, but today Twin Disc Clutch Co. engineers in Rockford, Ill. are happy with results achieved in surface finish, tool life and the elimination of grinding. **Page 110**
- **Multi-Purpose Tooling**—A check list enables you to evaluate the possibilities for functional, multi-purpose tools. Author C. F. Brown takes you step-by-step through a couple of examples of multi-purpose tooling developed for two similar parts where milling is the major operation. **Page 117**

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Hitchcock District Managers are listed on Page 72.

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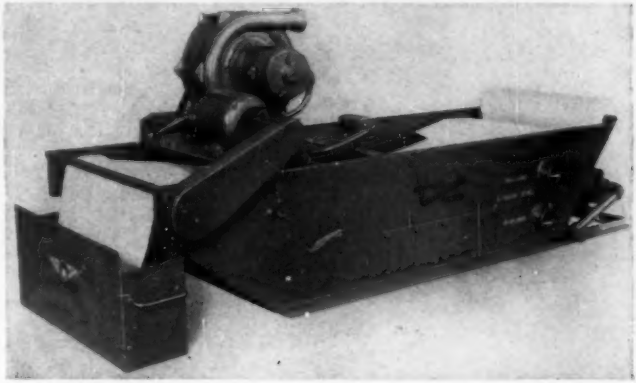
Employing a new vacuum method, the compact, revolutionary Hoffman Vacu-Matic Filter provides unusually high



flow rates in continuous filtration of machine tool water soluble coolants. Filter medium is an easily replenished paper on which solid particles are deposited. Coolant is drawn through the filtering paper by negative pressure with the dry sludge remaining on top of the paper. When sludge reaches a pre-set thickness, the filter paper is automatically indexed by a pressure differential switch and new paper moved over the vacuum area. Water-free sludge and filter paper drop off into the removable tote box for easy disposal. *Coolant loss is minimized . . . rejects reduced . . . down time eliminated...bacterial growth curtailed...production schedules maintained.* Ask for bulletin FB-103 — **U. S. Hoffman Machinery Corp., Thompson Road Plant #1, Syracuse, N. Y.**

Use postpaid card. Circle No. 426

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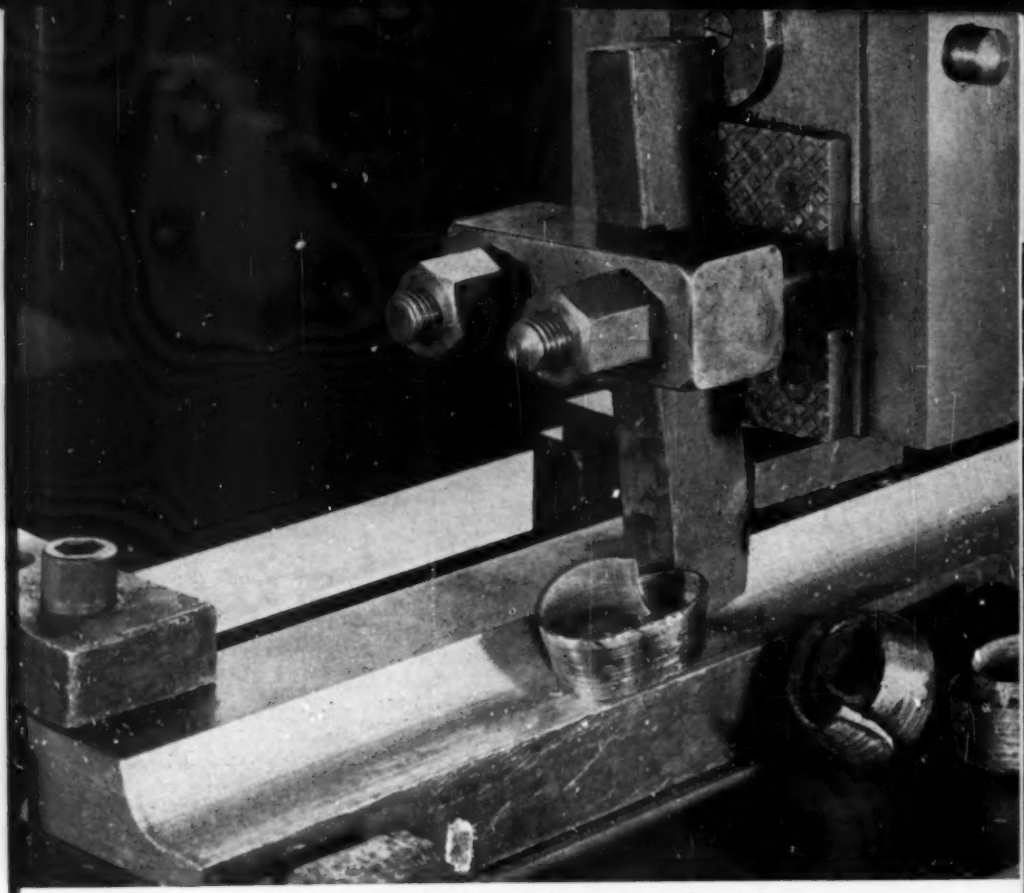

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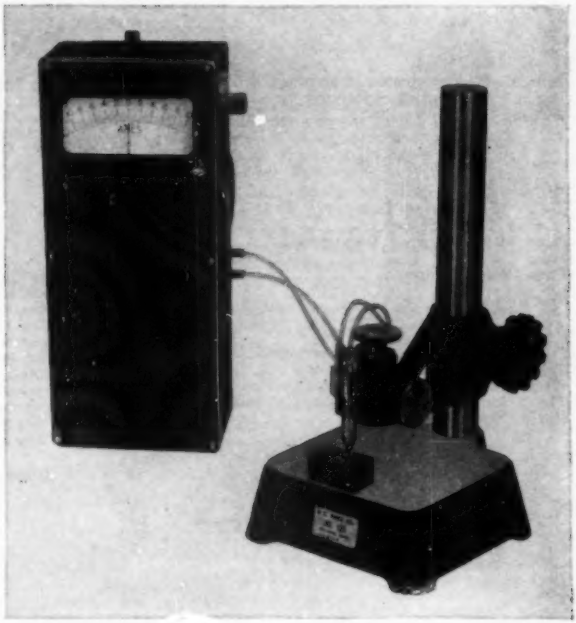

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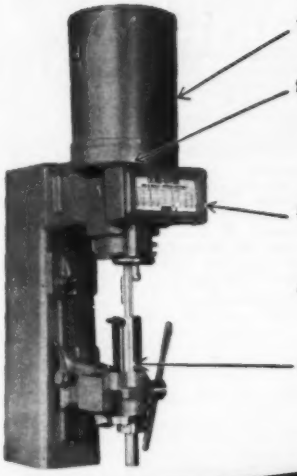

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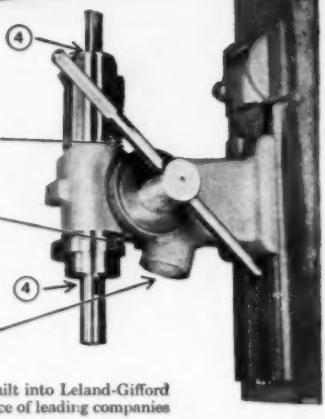

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1-1/8	7-8-10-12-14-16-18-20-24-27-32-36
1-3/16	8-10-12-14-16-18-20-24-27-32
1-1/4	7-8-10-12-14-16-18-20-24-27-32
1-5/16	6-8-10-12-14-16-18-20-24-27-32
1-3/8	6-8-10-12-14-16-18-20-24-27-32
1-7/16	8-10-12-14-16-18-20-24
1-1/2	6-8-10-12-14-16-18-20-24
1-9/16	12-14-16-18-20-24
1-5/8	5½-6-8-10-12-14-16-18-20-24
1-11/16	6-8-10-12-14-16-18-20-24
1-3/4	5-8-10-12-14-16-18-20-24
1-13/16	8-10-12-14-16-18-20-24-32
1-7/8	5-8-10-12-14-16-18-20-24
1-15/16	5-6-8-10-12-14-16-18-20
2	8-10-12-14-16-18-20
2-1/16	12-14-16
2-1/8	8-10-12-14-16-18-20
2-3/16	10-12-14-16
2-1/4	4½-8-10-12-14-16-18
2-5/16	12-14-16-18
2-3/8	10-12-14-16-18
2-1/2	4-8-10-12-14-16-18
2-9/16	12-14
2-5/8	8-10-12-14-16-18
2-3/4	4-8-10-12-14-16
2-7/8	8-10-12-14-16
3	4-8-10-12-15-16
3¼	8-10-12-14-16
3½	8-10-12-14-16
3¾	4-8-10-12-14
4	8-10-12

HIGH SPEED LEFT HAND TAPS

SIZE	THREAD
0	80
1	56-64-72
2	56-64
3	56
4	32-36-40-48
5	40-44
6	32-36-40
8	32-36-40
10	24-30-32-40
12	24-28-32
1/4	20-28-32
5/16	18-20-24-28-32
3/8	16-24-32
7/16	14-20-28
1/2	12-13-20-28
9/16	12-18-20-24
5/8	11-12-18-20-24
11/16	11-16-24
3/4	10-16-18-20
13/16	16
7/8	9-12-14-18-20
1	8-12-14-16-18-20
1-1/8	7-12
1-1/4	7-12-16-18
1-3/8	6-8-10-12-16-18-20-24
1-7/8	8-10-12-14-16-18-20
1-1/2	6-8-10-12-16-18-20
1-9/16	8-10-12-16-18-20
1-5/8	8-10-12-14-16-18-20
1-11/16	8-10-12-14-16-18-20
1-3/4	8-10-12-14-16-18-20
1-13/16	8-10-12-14-16-18-20
1-7/8	8-10-12-14-16-18-20
1-15/16	8-10-12-14-16-18-20
2	4½-10-12

• SPECIAL AND LEFT HAND DIES IN STOCK •

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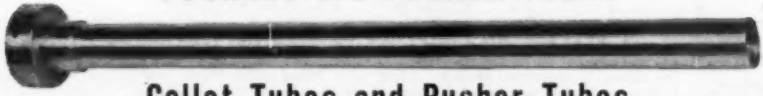

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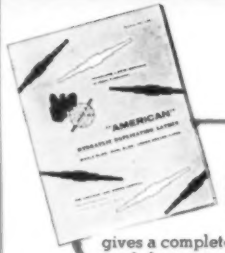

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gives a complete description and shows many examples. It's yours for the asking.

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